Data Report for the Research Cruise Onboard the *CCGS John P. Tully* and the *F/V Double Decker* to Bowie Seamount and Queen Charlotte Islands July 31st to August 14th 2000

K.L. Yamanaka

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
V9T 6N7

2005

Canadian Data Report of Fisheries and Aquatic Sciences 1163

Fisheries and Oceans | Pêches et Océans

Canada

Canadian Data Report of
Fisheries and Aquatic Sciences

Data reports provide a medium for filing and archiving data compilations where little or no analysis is included. Such compilations commonly will have been prepared in support of other journal publications or reports. The subject matter of data reports reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Data reports are not intended for general distribution and the contents must not be referred to in other publications without prior written authorization from the issuing establishment. The correct citation appears above the abstract of each report. Data reports are abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1 - 25 in this series were issued as Fisheries and Marine Service Data Records. Numbers 26 - 160 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Data Reports. The current series name was introduced with the publication of report number 161.

Data reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport statistique canadien des
sciences halieutiques et aquatiques

Les rapports statistiques servent à classer et à archiver les compilations de données pour lesquelles il y a peu ou point d'analyse. Ces compilations auront d'ordinaire été préparées à l'appui d'autres publications ou rapports. Les sujets des rapports statistiques reflètent la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports statisiques ne sont pas destinés à une vaste distribution et leur contenu ne doit pas être mentionné dans une publication sans autorisation écrite préalable de l'établissement auteur. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports statisiques sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1 à 25 de cette série ont été publiés à titre de relevés statistiques, Services des pêches et de la mer. Les numéros 26 à 160 ont été publiés à titre de rapports statistiques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 161.

Les rapports statistiques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

106-00357/

Canadian Data Report of

Fisheries and Aquatic Sciences 1163

2005

DATA REPORT FOR THE RESEARCH CRUISE ONBOARD THE *CCGS John P. Tully* AND THE *F/V Double Decker* TO BOWIE SEAMOUNT AND QUEEN CHARLOTTE ISLANDS JULY 31ST TO AUGUST 14TH 2000

by

K.L. Yamanaka

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
V9T 6N7

© Her Majesty the Queen in Right of Canada, 2005
Cat. No. Fs 97-13/1163E ISSN 0706-6465

Correct citation for this publication:

Yamanaka, K.L. 2005. Data report for the research cruise onboard the *CCGS John P. Tully* and the *F/V Double Decker* to Bowie Seamount and Queen Charlotte Islands July 31st to August 14th 2000. Can. Data. Rep. Fish. Aquat. Sci. 1163: vii + 46 p.

Table of Contents

Table of Contents iii
List of Figures iv
List of Tables v
List of Appendices vi
ABSTRACT vii
RÉSUMÉ vii
INTRODUCTION 1
METHODS 2
- General Overview 2
- Submersible Transects 2
- Longline Fishing 3
- Biological Sampling 4
- Fish Health Sampling 4
- Oceanographic Data 4
- Marine Seabird and Mammal Observations 5

RESULTS AND DISCUSSION 5
- Submersible Transects 5
- Longline Fishing and Biological Sampling 5
- Fish Health Sampling 6
- Oceanographic Ddata 6
- Marine Seabird and Mammal Observations 7

ACKNOWLEDGEMENTS 7
REFERENCES 7

List of Figures

Figure 1. Study sites at Bowie seamount with an inset showing the submersible dives (coloured lines) draped over the Bowie seamount multibeam bathymetry from the Canadian Hydrographic Service (CHS) and U.S. National Oceanographic and Atmospheric Administration (NOAA) and Gwaii Haanas with an inset showing the submersible dives (black lines) draped over multibeam bathymetry from CHS and the Pacific Geoscience Centre of Natural Resources Canada. 8

Figure 2. Two person submersible DELTA (Delta Oceanographics) on the deck of the CCGS John P. Tully. 9

Figure 3. Diagram of the relationships among the three vessels during the survey. Location data and verbal communication transfers are shown as long dashed lines. Red lasers are shown as short dashed lines and cameras shown as C 9

Figure 4. Delta submersible secured on the starboard side of the CCGS John P. Tully. 10

Figure 5. F/V Double Decker a 65 foot (19.8 m) commercial longline vessel. 10

Figure 6. Location of Delta submersible transects, on Bowie Seamount, conducted upslope from deep to shallow shown in panel a. Location of F/V Double Decker's longline fishing sets showing start position and direction of set in panel b. 11

Figure 7. Location of Delta submersible transects, in Gwaii Haanas, conducted upslope from deep to shallow shown in panel a. Location of F/V Double Decker's longline fishing sets showing start position and direction of set in panel b. 12

Figure 8. Age (top panels) and forklength (bottom panels) frequencies for yelloweye (YE) and rougheye (RE) rockfish at Bowie seamount and yelloweye rockfish in the Queen Charlotte Islands (QCI). n=sample size. 13

Figure 9. Length-weight relationship for yelloweye and rougheye rockfish caught by longline at Bowie seamount and yelloweye rockfish in the Queen Charlotte Islands (QCI). n=sample size 14

List of Tables

Table 1. Summary of DELTA submersible dives with date and start time, type of dive, duration, pilot and observer names and general location. 15

Table 2. Summary of DELTA submersible dive number and transects conducted, depths, starting position and the total yelloweye and rougheye rockfish counted visually during the dive. . 16

Table 3. List of rock samples collected with the *Delta* submersible showing dive number, location (degree minutes), depth, date and time of collection. 17

Table 4. Common and scientific names, species codes and numbers of rougheye and yelloweye rockfish counted during Delta submersible dives at Bowie seamount. Other species observed during dives are listed. 18

Table 5. Common and scientific names, species codes and numbers of rougheye and yelloweye rockfish counted during Delta submersible dives in the Queen Charlotte Islands. Other species observed during dives are listed. 19

Table 6. Summary of F/V Double Decker fishing locations by date, set number, hook count (14/0 hook size), start time, location (degree minutes) and depth (metres). Sets 1 to 9 were on Bowie Seamount and sets 10 to 17 were in the Queen Charlotte Islands. 20

Table 7. Summary of catch (numbers) by species and set number for all F/V Double Decker fishing sets at Bowie seamount. 21

Table 8. Summary of catch (numbers) by species and set number for all F/V Double Decker longline fishing sets in the Queen Charlotte Islands. 22

Table 9. Number of biological samples (N) collected by species. Sample types include length and sex (L/S), maturity and otoliths (M/O) for all longline fishing sets on the F/V Double Decker at Bowie Seamount. 23

Table 10. Number of biological samples collected by species. Sample types include length (L), sex (S), maturity (M) and otoliths (O) for all longline fishing sets on the F/V Double Decker in the Queen Charlotte Islands. 24

Table 11. Summary statistics for length, weight, and age for yelloweye and rougheye rockfish and length for rosethorn rockfish from F/V Double Decker longline fishing sets at Bowie seamount 25

Table 12. Summary statistics for length, weight and age for yelloweye rockfish and length for rosethorn, redbanded, silvergray and canary rockfishes, lingcod and ratfish from F/V Double Decker longline fishing sets in the Queen Charlotte Islands 25

List of Appendices

Appendix 1. PACIFIC REGION CCG VESSEL -POST CRUISE REPORT 27

Appendix 2. Bowie Seamount 2000 Fish Health Survey Histological reference # H00-095 33

Appendix 3. Summary of Oceanographic Data Collected on John P. Tully Cruise July 31 - August 14, 2000. Note: All data held at UBC. Contact Dr. John Dower..... 37

Appendix 4. CTD PROCESSING NOTES 39

Appendix 5. Trip Summary, Seabirds and Marine Mammals, Bowie Seamount, August 2 - 13 2000. 44

Appendix 6. Codes and descriptions for habitat classifications. 46

ABSTRACT

Yamanaka, K.L 2005. Data report for the research cruise onboard the *CCGS John P. Tully* and the *F/V Double Decker* to Bowie Seamount and Queen Charlotte Islands July 31st to August 14th 2000. Can. Data. Rep. Fish. Aquat. Sci. 1163: vii + 46 p.

A description of the operations and data collected during a multidisciplinary research cruise to Bowie seamount and the Queen Charlotte Islands are reported. Operations include the use of the *Delta* submersible to enumerate benthic rockfish and their habitat along transects and longline surveys to evaluate catch rates in relation to visual abundance estimates. Other data collected include rock samples from the submersible, biological and fish health samples from the longline catch, CTD and bongo net tows and marine seabird and mammal observations.

RÉSUMÉ

Yamanaka, K.L 2005. Data report for the research cruise onboard the *CCGS John P. Tully* and the *F/V Double Decker* to Bowie Seamount and Queen Charlotte Islands July 31st to August 14th 2000. Can. Data. Rep. Fish. Aquat. Sci. 1163: vii + 46 p.

Ce rapport comporte une description des opérations et des données recueillies lors d'une croisière de recherche multidisciplinaire au mont sous-marin Bowie et aux îles de la Reine-Charlotte. Les opérations ont notamment consisté à utiliser le sous-marin *Delta* pour dénombrer les sébastes benthiques et identifier leurs habitats lors de relevés effectués le long de transects à l'aide de palangres. L'objectif était d'évaluer le taux de capture en fonction des estimations visuelles des effectifs. Les chercheurs ont également recueilli des échantillons de roches à l'aide du submersible, des échantillons biologiques sur les poissons capturés à la palangre ainsi que des données sur la conductivité, la température et la profondeur de l'eau, des échantillons de plancton à l'aide de filets de type Bongo et ils ont effectué des observations sur les oiseaux et les mammifères marins présents sur les sites.

INTRODUCTION

A multidisciplinary research cruise to Bowie Seamount (53°18' N 135° 40' W) and the southwest coast of Moresby Island (between 52° 03'N 131° 13' W and 52° 12' N and 131° 27' W) in the Queen Charlotte Islands was conducted from July 31 to August 14, 2000 onboard the *CCGS John P. Tully*. Scientific staff onboard were from the Department of Fisheries and Oceans (DFO, Stock Assessment and Aquaculture Divisions and Oceans Directorate), University of British Columbia (UBC, Earth and Ocean Sciences), Parks and Heritage Canada (PHC, Gwaii Haanas National Park Reserve/Haida Heritage Site), University of California (UC, Santa Barbara), and the Environment Canada (EC, Canadian Wilderness Service). Post cruise report in Appendix 1.

Research objectives were to develop *in-situ* visual methods to assess inshore (benthic) rockfish stocks and initiate ecosystem assessment research by investigating links between Bowie seamount and Queen Charlotte Island rockfish populations and ocean environments and the influences of large ocean transport mechanisms, like the Haida Eddy. Specific stock assessment objectives were to:

1) use submersible observations to estimate abundance and determine habitats of yelloweye rockfish between 50 and 350 m,
2) characterize the physical rockfish habitat through visual, oceanographic and geologic data collections,
3) conduct longline fishing experiments to enable the comparison of visual submersible indices of abundance with traditional fishery dependent indices,
4) conduct biological sampling for catch rate, species composition, age structures, morphology, and fish health for use in stock assessment. and
5) provide a video library of submersible dives for documenting the marine fauna, flora and physical morphology of the study sites and to ground-truth habitat assessments interpreted from multibeam sonar data.

The Bowie seamount and Queen Charlotte Island areas were chosen as survey sites because of their fishing history and apparent rockfish biomass as well as their status as a Pilot Marine Protected Area and a proposed National Marine Conservation Area Reserve, respectively. Bowie seamount is located 180 km west of the Queen Charlotte Islands (QCI) in northern British Columbia (B.C.) and is the shallowest seamount in the Canadian North Pacific (Figure 1). The seamount area is of interest to the Oceans Directorate of the Department of Fisheries and Oceans Canada (DFO) to designate as a Marine Protected Area (MPA) under the *Oceans Act*. The southwest coast of Moresby Island (between 52° 03'N 131° 13' W and 52° 12' N and 131° 27' W) in the Queen Charlotte Islands is within the Gwaii Haanas National Park Reserve and is under consideration as a National Marine Conservation Area Reserve (NMCAR). The Bowie seamount area has a commercial fishery for halibut and a limited 'Scientific permit' fishery for sablefish and rockfish. Scientific permits for sablefish fishing were first granted in 1983 and have continued as a licence amendment since 1991. Scientific permits for rockfish fishing were granted between 1994 and 2000. The southwestern portion of Moresby Island in the QCI was closed to the directed rockfish and halibut longline commercial fishery for rockfish conservation between 1999 and 2003.

The *CCGS John P. Tully* was accompanied on this research cruise by the *F/V Double Decker* which served to track the *DELTA* submersible (Delta Oceanographics) while conducting underwater transects and completed research fishing sets along the submersible transects subsequent to the submersible dives. The data collections from the research cruise number 2000-31 onboard the *CCGS John P. Tully* and the *F/V Double Decker*, between August 3rd and 12th, 2000 are summarized in this report. Ms. Sheila Dawe, Dr. John Dower and Mr. Ken Morgan provided overviews of the fish health sampling, oceanographic data collections and marine bird and mammal observations, respectively. These are referred to in this report and included as Appendices.

METHODS

General Overview

The *CCGS John P. Tully* departed the Institute of Ocean Sciences (IOS) the morning of July 31, 2000 and traveled to Christie Pass, outside of Port Hardy, to meet the *F/V Double Decker*. Equipment and personnel were transferred and a check-out dive with the submersible was completed to ensure that the communication and tracking systems worked well. The vessels departed for Bowie seamount August 1st. The *CCGS John P. Tully* reached Bowie seamount on August 3 and began submersible and fishing operations until August 7th when the vessels departed for the Queen Charlotte Islands. Operations on the southwest side of the Queen Charlotte Islands commenced on August 8th and continued through to August 12th. The cruise ended on August 14th at the Graving Dock in Esquimalt.

Daily research operations commenced with the deployment of the *Delta* submersible from the *CCGS John P. Tully*. Once launched the submersible was tendered by the *F/V Double Decker*. When submersible operations were completed for the day, the *F/V Double Decker* began the fishing experiments and the biological and fish health sampling and the *CCGS John P. Tully* began oceanographic data collections. Oceanographic data collections continued through the night and ended when the *CCGS John P. Tully* was required to be in position for the *Delta* dives in the morning. Marine mammal and seabird observations were conducted throughout the cruise.

Submersible Transects

The *Delta* is a two person self-contained submersible capable of diving to depths of 365 m (1200 ft) (Figure 2). The pilot sits upright and maneuvers the submersible by looking through the ports of the conning tower and the observer lies prone on their left side to view out of the starboard ports of the submersible.

Cameras and lasers are mounted externally, with a forward-view as well as a starboard side-view camera (Figure 3). Each camera is mounted with parallel lasers for measuring objects in the field of view. Two additional lasers are mounted; one forward to demarcate the right hand side of a 1 metre strip visible in the forward view and one vertical to demarcate a zero line, visible from the starboard port, to estimate perpendicular distances. This camera and laser configuration allows for the enumeration of fish using strip transect methods with the forward-view camera and line transect methods with the starboard side-view. Video recorders for each camera are

located within the submersible. Depth sensors mounted externally on the submersible output data to a Pisces unit which records depth, date and time data directly onto the videotape. Positioning data is logged to a spreadsheet from GeoPacific Solutions WinFrog navigational software which uses the combined inputs from an ORE Trackpoint system on the submersible and fluxgate compass onboard the *F/V Double Decker*. The *Delta* was also able to collect rock samples using a manipulator arm maneuvered manually from within the submersible.

The *Delta* was deployed over the starboard side of the *CCGS John P. Tully* (Figure 4). Between dives the submersible was suspended from the aft crane and tied to the starboard side of the *CCGS John P. Tully* on a rubber tire mat to allow the exchange of pilots and observers. At the dive location, the observer and pilot entered the submersible from the conning tower hatch and once contained were lowered to the water and released. The *F/V Double Decker* then closely followed the submersible to transmit/receive voice communications and geographic positioning data.

The seamount was divided into three sections along the ridge and three depth intervals (50-150 m, 150-250 m and 250-350 m). Submersible dive positions within each of the 9 section/depth blocks were chosen at random. Dives on the southwest coast of Moresby Island were staggered north to south between McLean Fraser Point and Cape St. James on Kungit Island. One dive was also conducted on the east side of Kungit Island due to unfavourable weather on the west side. Starting positions were chosen at random from areas with suitable depths.

Dives began from the deepest depth and traversed upslope, starboard side to the slope, to maintain a view of the bottom through the starboard port. Each submersible dive consisted of two 30 minute transects with a 10 minute break between transects for photography and repositioning. Rock sample collection was depth dependant and where pressure permitted collection of a rock occurred. At the start of each transect and at each 5 minute interval during the dive, depth and positions were manually taken as a backup to the WinFrog output.

Line transect methods were deployed similar to studies in Alaska (O'Connell, V.M. etal 1998). During the dive, fish species were identified and for yelloweye and rougheye rockfish, estimates were made of their distance from the transect line by viewing out the starboard port. A hand held sonar unit fitted with a water membrane was used through the viewing port plexiglass to estimate the distance of rocks from the submersible and train the eye of the observer in estimating perpendicular distances from the transect line.

Post-processing of the videotape was conducted to assess habitat and enumerate fish by voice recordings and visual review of both the forward and the side view videotape. Both videotapes were reviewed side by side to properly assign fish viewed in the forward camera. Fish that were seen on the center line that moved to the port side (blind side) of the submersible were added to the counts and conversely fish that swam into the transect from the port side were removed.

Longline Fishing

The *F/V Double Decker* is a 65 foot (19.8 m) fiberglass commercial longline vessel that was chartered to tender the submersible and conduct the experimental fishing (Figure 5). The fishing

vessel had a crew of 4 and was skippered by Mr. Gerald Dalum. *Delta's* communication and navigational equipment was installed onboard the fishing vessel to conduct the tracking. The vessel's plotter was also used to record the submersible dive and allowed the skipper to deploy the fishing gear directly over dive track.

The fishing gear consisted of either 14/0 or 2/0 Mustad circle hooks attached to perlon with swivels and snapped along a 'halibut' groundline at 8 foot spacing (2.4 m) or commercial prawn traps snapped along a groundline. Two experimental strings of gear, one short string of 2/0 hooks and one string of 6 prawn traps was set at the seamount in an attempt to catch smaller fish. Standard 14/0 hook longline gear was used to place along the length of the submersible dives. Soak time for this standard gear was two hours.

Biological Sampling

As the longline gear was retrieved, hook by hook species composition data was collected and when gear retrieval was complete, biological sampling was conducted. Forklength (mm) and weight (gm) were measured, sex and maturity determined visually, otoliths removed for age determination and caudal fin sampled for genetic analyses. Mr. Steve Sviatko and other DFO staff, together with the ship's crew conducted the biological sampling.

Rockfish ages were determined in the Pacific Biological Station Fish (PBS) Ageing Lab using the break and burn method (MacLellan 1997). Genetic samples were processed at the PBS Genetics Lab using microsatellite DNA techniques (Yamanaka et al 2001).

Fish Health Sampling

Fish health samples were also collected onboard the *F/V Double Decker* by Ms. Sheila Dawe (DFO) as part of a Pacific coastwide rockfish survey coordinated through Dr. Michael Kent at Oregon State University (Appendix 2). Blood samples were collected for erythrocytic inclusion body syndrome (EIBS) virus, kidney was collected and frozen for viral and bacteriological assays. Lower intestine, kidney, spleen, pyloric caecae, liver, heart, flesh, gills, and brain tissues were also sampled for histology.

Oceanographic Data

Dr. John Dower, Mr. David Jones and Ms. Tawnya Peterson (Oceanography, University of British Columbia) conducted the oceanographic sampling with the CTD rosette and bongo nets (Appendix 3). Salinity, temperature and depth (CTD) data, as well as, water samples for the analyses of dissolved nutrients and size-fractionated chlorophyll, were collected using a rosette deployed over the stern of the *CCGS John P. Tully*. Vertical bongo tows (0-50m and 0-150m) were completed using 80cm bongo-nets (236 Φm mesh). Samples were preserved in 95% ethanol (larval fish) or 5% buffered-seawater formalin. Current data were collected using the ship's acoustic Doppler current profiler (ADCP) throughout the cruise.

Marine Seabird and Mammal Observations

Transects to identify and enumerate sea birds were conducted by Mr. Michael Bentley (contracted by Mr. Ken Morgan at the Canadian Wildlife Service) throughout the cruise (Appendix 5). All birds encountered within 250 m of the vessel were recorded. Observations of marine mammals, regardless of distance from the vessel were recorded.

RESULTS AND DISCUSSION

Submersible Transects

A total of 31 submersible dives were conducted on the cruise (Table 1). Ten research dives and 20 transects were completed at both Bowie Seamount and Gwaii Haanas. Dives were conducted between 26 to 334 m in depth over the survey with transects ranging from 53 to 306 m in depth at Bowie seamount and from 62 m to 231 m in The Queen Charlotte Islands (Table 2). Four rocks were collected from the seamount and 2 rocks from the Charlottes (Table 3).

Many fish were identified from the submersible, however, only yelloweye and rougheye rockfish were enumerated at Bowie seamount (Tables 4 and 5). Numbers of yelloweye and rougheye rockfish ranged from 0 to 410 and 0 to 661 fish, respectively, per submersible dive.

Habitats were described and coded from the videotape (Appendix 6). Bowie seamount originates from volcanic activity and is built up from a succession of lava flows. The fish habitat is characterized by slopes of fine pumice gravel and differentially eroded lava outcrops and overhangs. Halibut, skates, sun stars and squat lobsters dominate the gravel slopes and rockfishes dominate the rock habitats. Yelloweye and rougheye rockfish, as well as, pelagic widow rockfish are present in high densities at the seamount. The Queen Charlotte Islands fish habitat is characterized by boulders with sand flats in between. Far fewer fish were seen in the Charlottes than the seamount (Table 2).

In-situ visual techniques using the DELTA submersible are invaluable for the study of inshore rockfish ecology, habitat and stock status.

Longline Fishing and Biological Sampling

Data from the 2000 *F/V Double Decker* trip are archived in the DFO GFBio database and can be retrieved by using TRIP_ID 36885.

A total of 17 fishing sets were conducted on the cruise (Table 6). Nine sets were fished at Bowie Seamount and eight sets in the Queen Charlotte Islands. Less fishing effort was expended at the seamount with 2733 hooks set compared to 3851 hooks set in the Charlottes. A wider range of depths were fished and two different hook sizes were used at the seamount.

Submersible dives were conducted prior to fishing with standardized longline gear. The *F/V Double Decker* maintained a record of the submersible dive location and set the longline gear

directly over a portion of the submersible dives at the seamount and in the Charlottes (Figures 6 and 7).

Species diversity was lower at Bowie seamount with eighteen species observed on the longline gear (hook by hook data) compared to twenty-four fish species in the Queen Charlotte Islands (Tables 7 and 8). Fifty-five and fifty percent of all the species caught on the longline gear were rockfish at the seamount and in the Charlottes, respectively. The catch at the seamount was largely rougheye, rosethorn and yelloweye rockfishes. The catch in the Charlottes was yelloweye and silvergray rockfishes, Pacific halibut and redbanded rockfish. Experimental prawn traps caught hairy tritons (*Fusitriton oregonesis*) and starfish and an experimental longline with small hooks caught largely rosethorn and yelloweye rockfish. This may be a result of less fishing effort on Bowie Seamount.

Biological samples were collected for 976 fish of 15 species at Bowie seamount and 1031 fish of 24 species in the Queen Charlotte Islands (Tables 9 and 10). Yelloweye rockfish sampled at the seamount displayed a wider age and size range and lower median age and size than those sampled in the Charlottes (Tables 11 and 12, Figure 8). For rosethorn rockfish this was reversed with a wider size range and lower median size in the Charlottes. This may be attributed to the experimental small hook gear set or the wider range of depths fished at the seamount.

Length-weight relationships for yelloweye and rougheye rockfish can be expressed as (Figure 9):

$W = a * L^{b}$ where W = whole wet weight in grams
L = fork length in centimetres

Bowie	yelloweye	a = 0.013, b = 3.097
	rougheye	a = 0.032, b = 2.822
QCI	yelloweye	a = 0.026, b = 2.913

Fish Health Sampling

One hundred and fourty-one fish of 12 species were sampled for fish health studies (Appendix 2). Nine of these species were rockfish.

Oceanographic Ddata

CTD rosette casts and bongo tows were conducted at 33 stations during the cruise (Appendix 3 and 4). Twenty stations were completed at Bowie Seamount and 10 stations at Gwaii Haanas. An additional 3 stations were taken approximately halfway between Bowie and Gwaii Haanas to provide background control data. Water samples for the analysis of dissolved nutrients and size-fractionated chloropl _ ll were collected. Neuston net tows were also conducted at the surface over Bowie Seamount. The Haida Eddy, which generates along the continental margin with nutrient rich waters, was stationary over Bowie Seamount during the cruise.

Marine Seabird and Mammal Observations

A total of 21 species of seabirds and 5 species of marine mammals were observed (Appendix 5). Five hundred and fifty-one, 5 minute seabird survey transects were conducted and continuous marine mammals observations were made. Of the 21 species of seabirds observed, only six species were observed at Bowie seamount (38 km radius of the pinnacle); fork-tailed and Leach's storm petrels, northern fulmars, black-footed albatross, Cassin's auklet and sooty shearwaters. Dall's porpoise were the only marine mammal observed at the seamount.

ACKNOWLEDGEMENTS

John Dower, David Jones, Tawnya Peterson from the University of British Columbia, Tomas Tomascik from Parks and Heritage Canada, Linda Snook from the University of California at Santa Barbara, Michael Bentley contracted by the Canadian Wildlife Service, Dave Slater, Chris Ijames and Joe Lilly from Delta Oceanographics, Rick Stanley, Steve Sviatko, Sheila Dawe and Paul Preston from DFO all participated in the cruise. This research was possible through direct funding from DFO's Oceans Directorate, PHC's Gwaii Haanas National Park Reserve and the International Pacific Halibut Commission.

Special thanks to Captain Paul Frost on the *CCGS John P. Tully* and Captain Gerald Dalum on the *F/V Double Decker,* without their knowledge and expertise this research cruise would not have been possible. Thanks also to the ship's crews and the Science crew for all their efforts to make this cruise a success.

Thanks to Rick Stanley who endured many submersible dives and reviewed videotape. Thanks to Lisa Lacko for organizing all the data into databases and Jon Martin for reviewing videotapes. The Ageing Lab at the Pacific Biological Station provided the age data and Lisa Lacko, Jon Martin and Chris Grandin prepared tables and figures for this document. Jeff Fargo reviewed the document.

REFERENCES

MacLellan, S. E. 1997. How to age Rockfish (Sebastes) using S. alutus as an example – The otolith burnt section technique. Can. Tech. Rep. Fish. Aquat. Sci. 2146: 39 p.

O'Connell, V.M., Carlile, D.W., and Wakefield, W.W. 1998. Using line transects and habitat-based assessment techniques to estimate the density of yelloweye rockfish (Scorpaenidae: *Sebastes*) in the Eastern Gulf of Alaska. *In*: International Council for the Exploration of the Sea. Copenhagen (Denmark). Theme Sess. On Deepwater Fish and Fisheries. ICES. 7 p.

Yamanaka, K.L., Withler, R.E., and Miller, K.M. 2000. Structure of Yelloweye Rockfish (*Sebastes ruberrimus*) Populations in British Columbia. Can. Stock Assess. Secretariat Res. Doc. 2000/172 32 p.

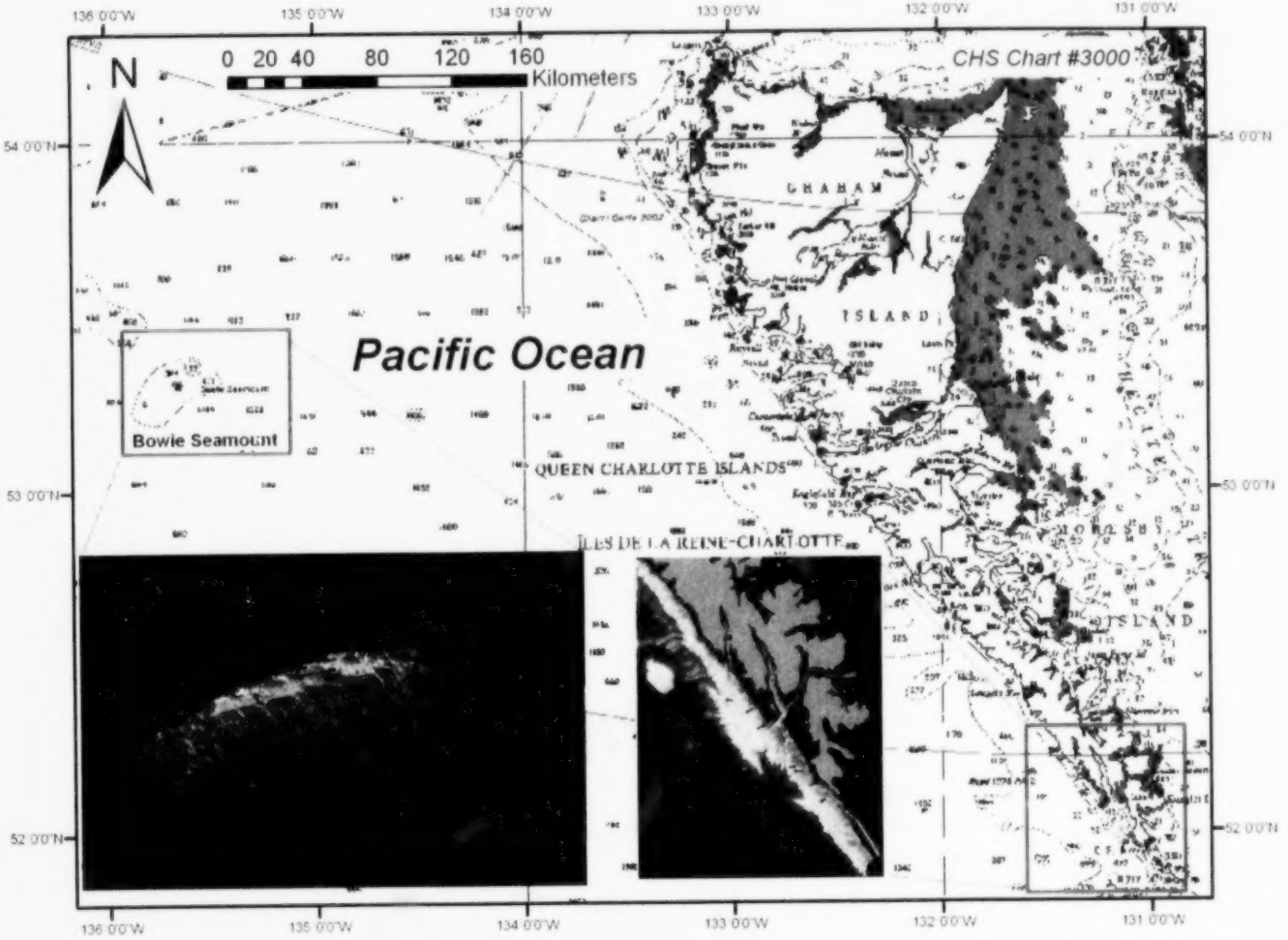

Figure 1. Study sites at Bowie seamount with an inset showing the submersible dives (coloured lines) draped over the Bowie seamount multibeam bathymetry from the Canadian Hydrographic Service (CHS) and U.S. National Oceanographic and Atmospheric Administration (NOAA) and Gwaii Haanas with an inset showing the submersible dives (black lines) draped over multibeam bathymetry from CHS and the Pacific Geoscience Centre of Natural Resources Canada.

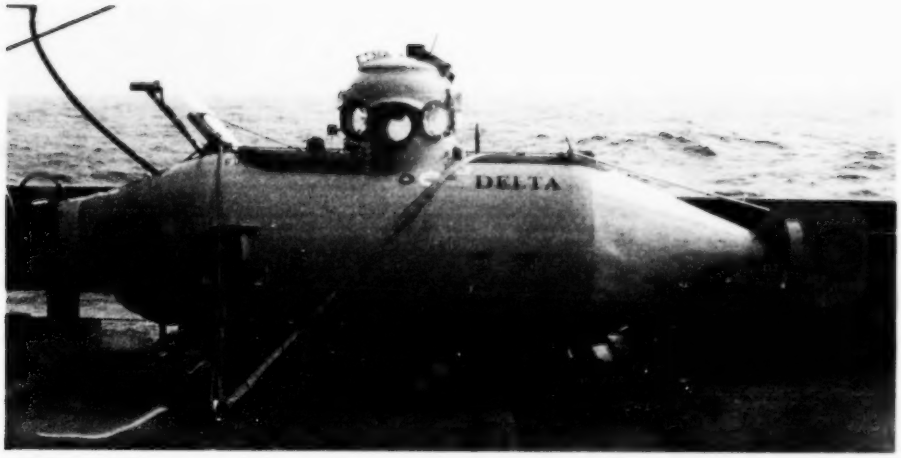

Figure 2. Two person submersible DELTA (Delta Oceanographics) on the deck of the CCGS John P. Tully.

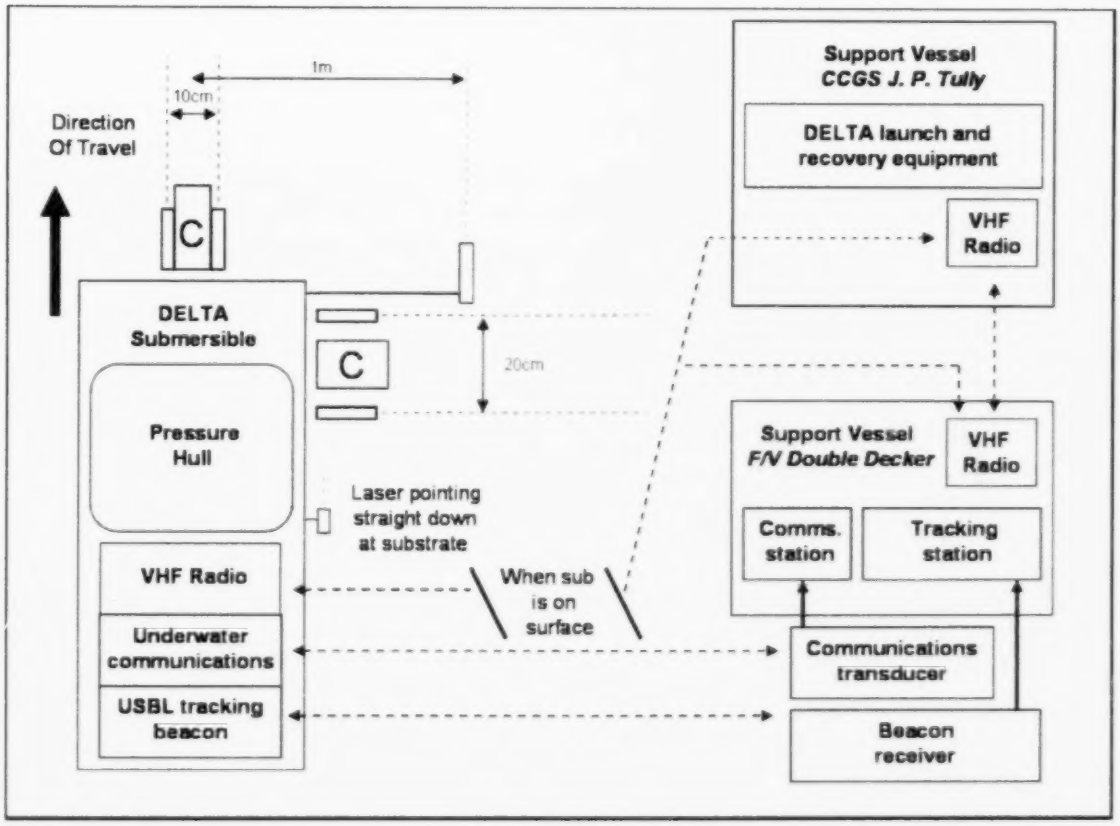

Figure 3. Diagram of the relationships among the three vessels during the survey. Location data and verbal communication transfers are shown as long dashed lines. Red lasers are shown as short dashed lines and cameras shown as C.

Figure 4. Delta submersible secured on the starboard side of the CCGS John P. Tully.

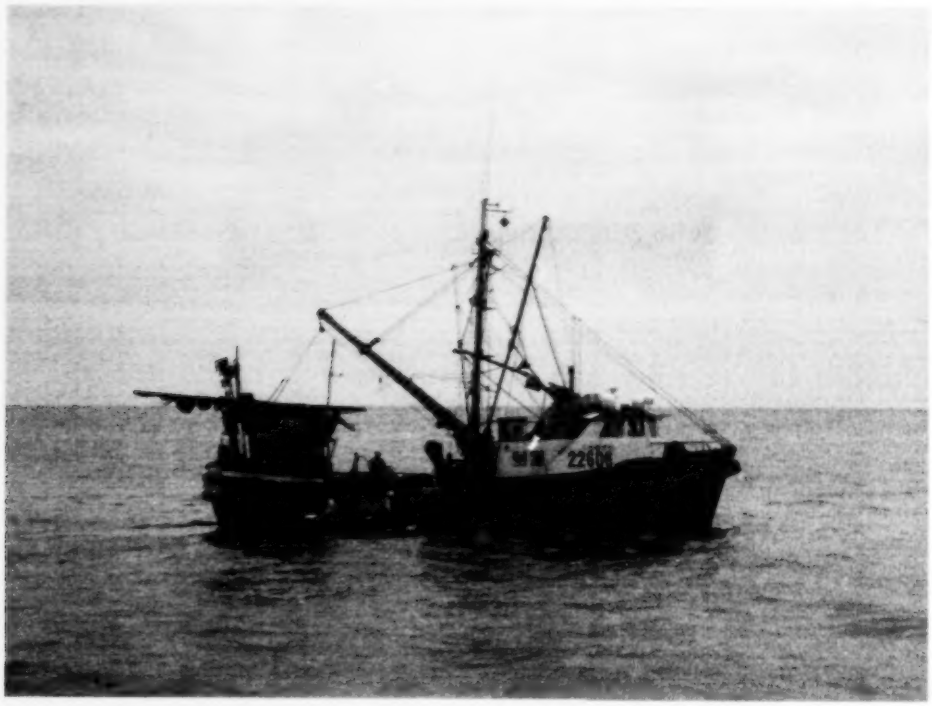

Figure 5. F/V Double Decker a 65 foot (19.8 m) commercial longline vessel.

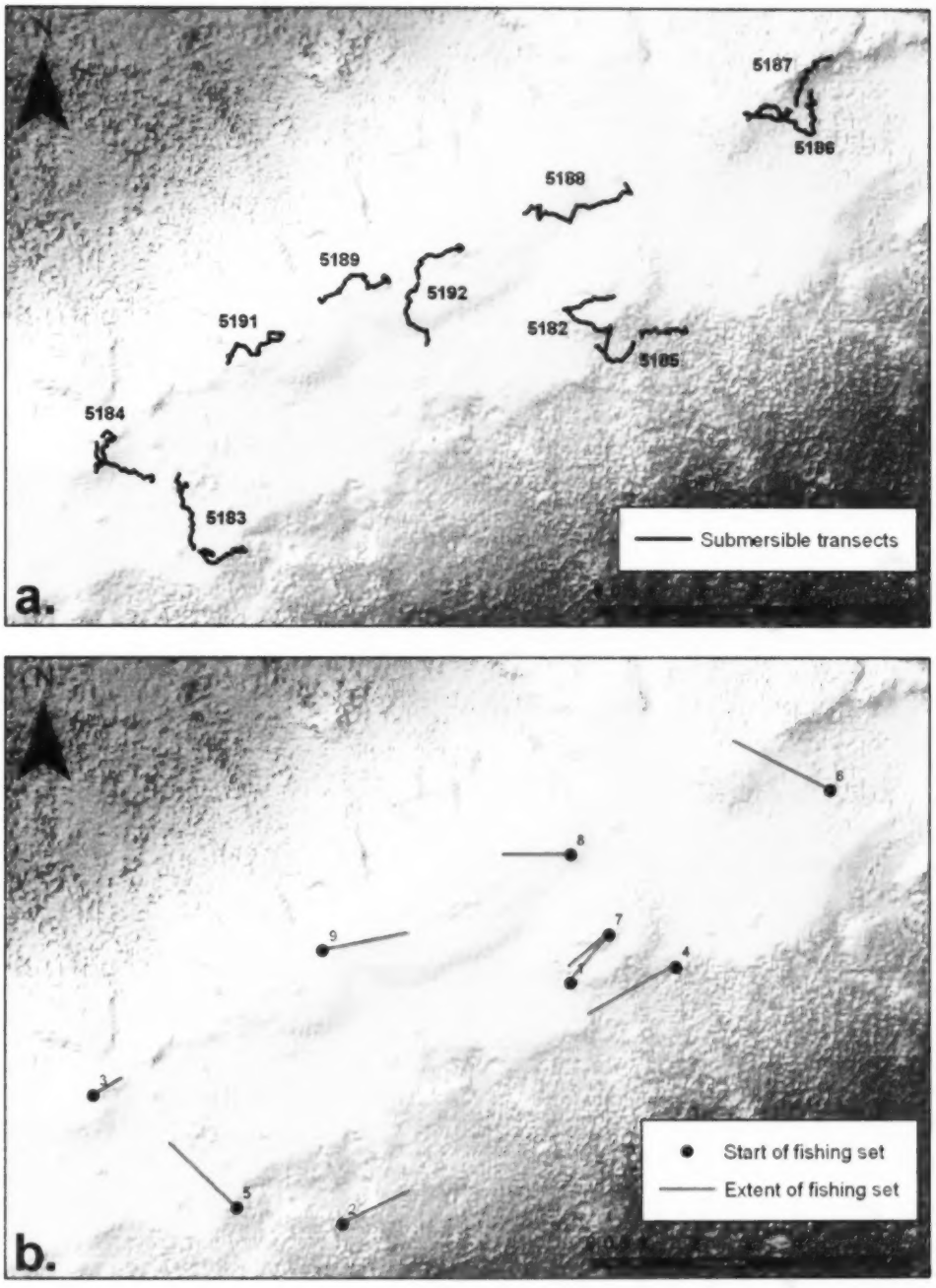

Figure 6. Location of Delta submersible transects, on Bowie Seamount, conducted upslope from deep to shallow shown in panel a. Location of F/V Double Decker's longline fishing sets showing start position and direction of set in panel b.

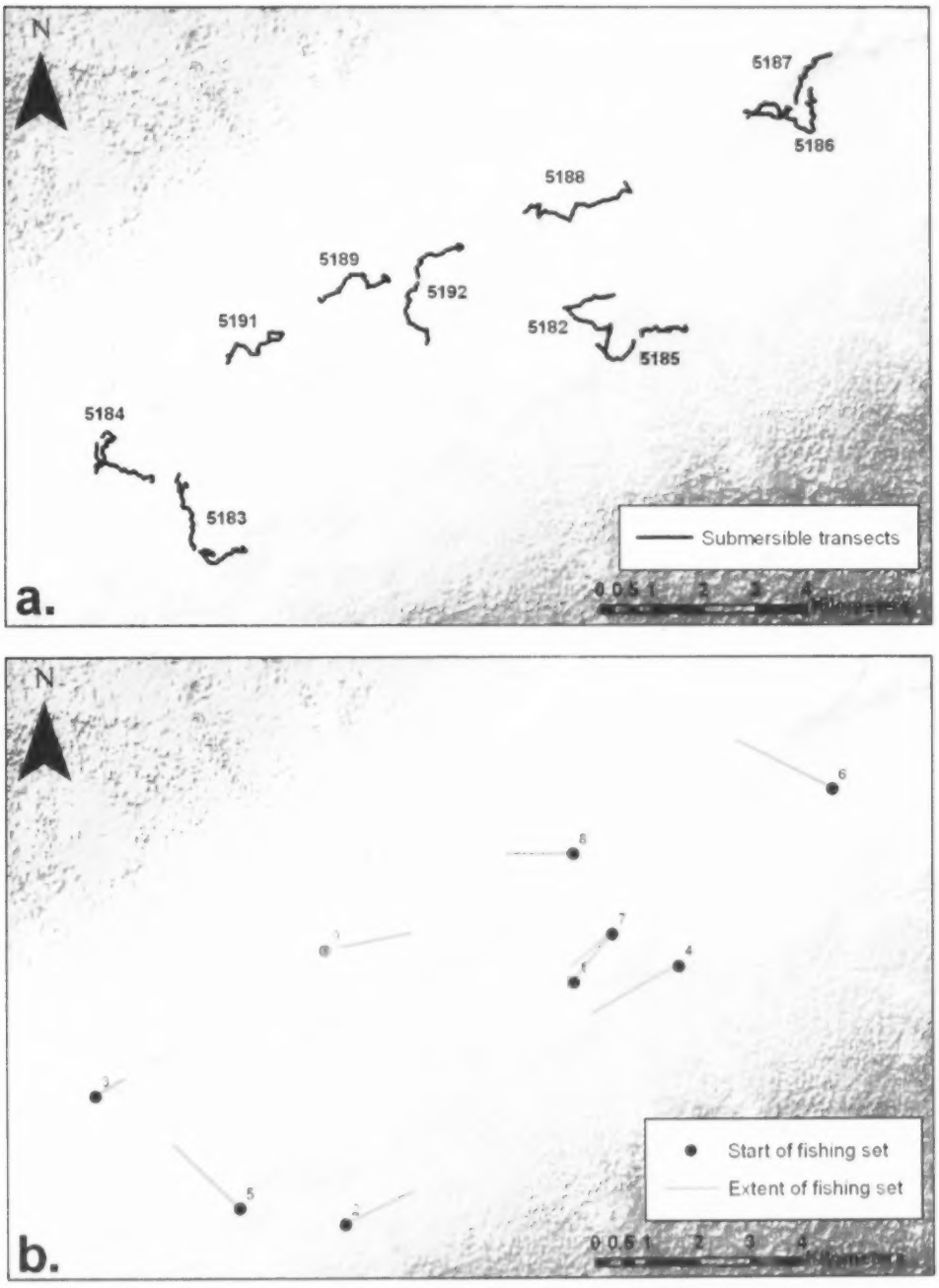

Figure 6. Location of Delta submersible transects, on Bowie Seamount, conducted upslope from deep to shallow shown in panel a. Location of F/V Double Decker's longline fishing sets showing start position and direction of set in panel b.

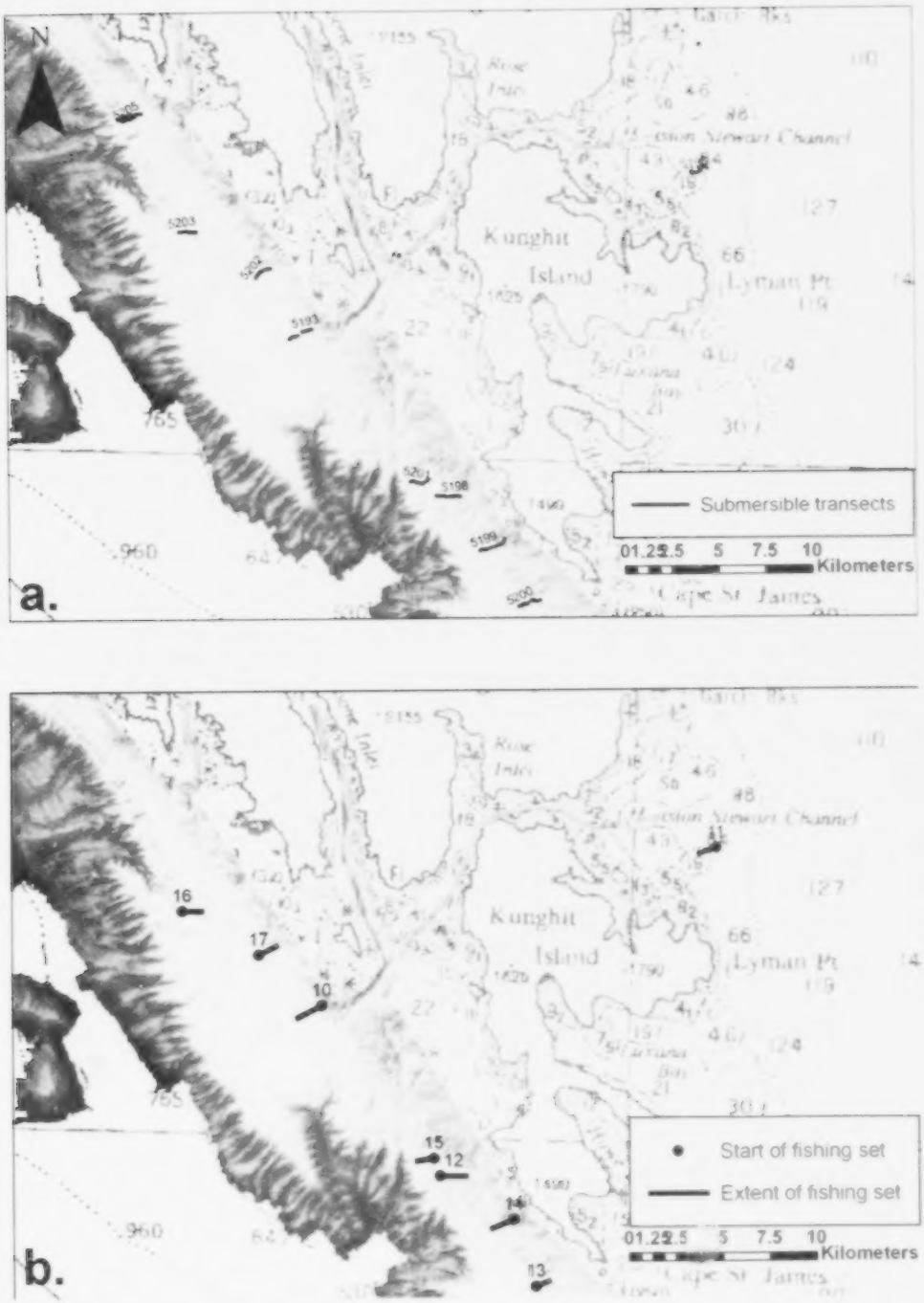

Figure 7. Location of Delta submersible transects, in Gwaii Haanas, conducted upslope from deep to shallow shown in panel a. Location of F/V Double Decker's longline fishing sets showing start position and direction of set in panel b.

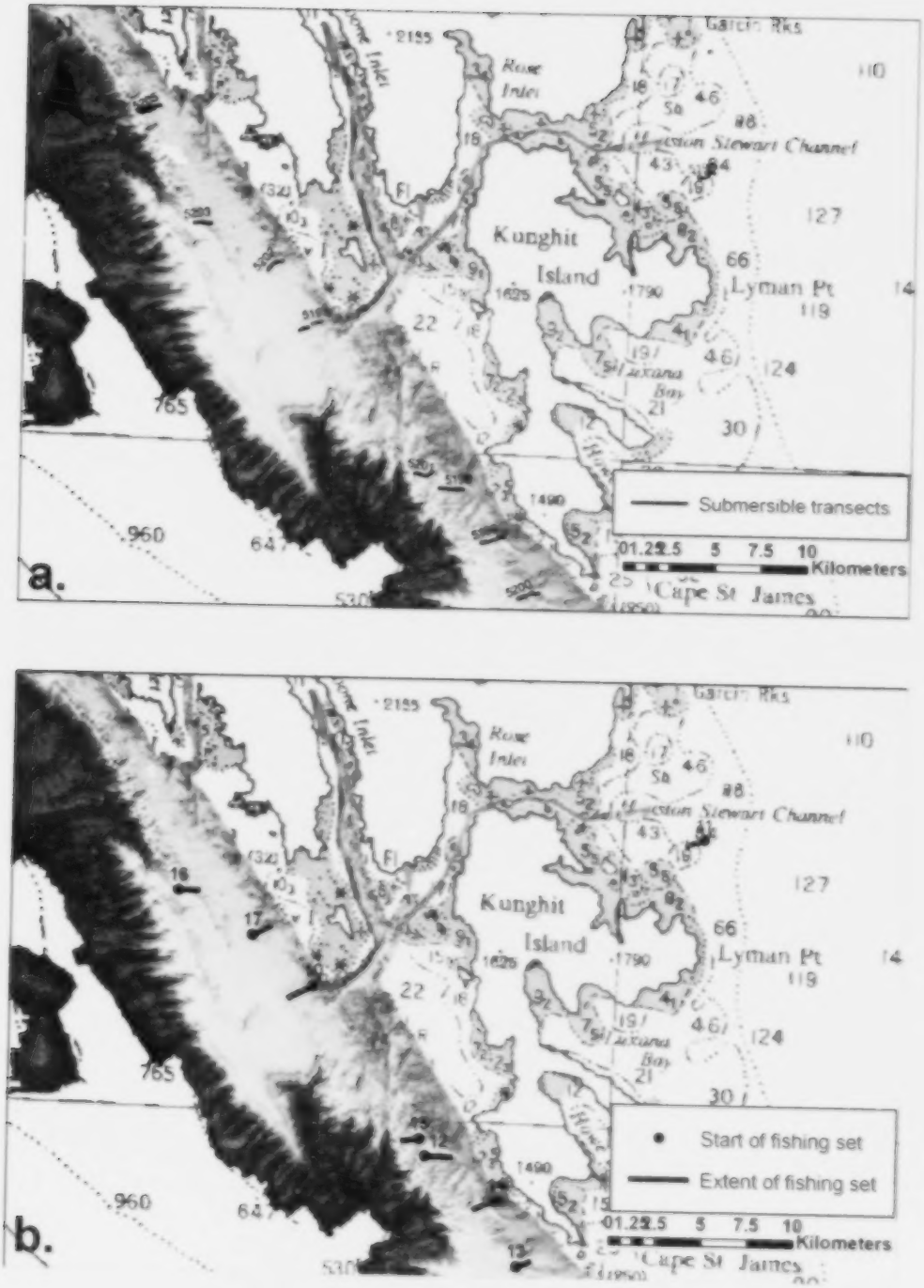

Figure 7. Location of Delta submersible transects, in Gwaii Haanas, conducted upslope from deep to shallow shown in panel a. Location of F/V Double Decker's longline fishing sets showing start position and direction of set in panel b.

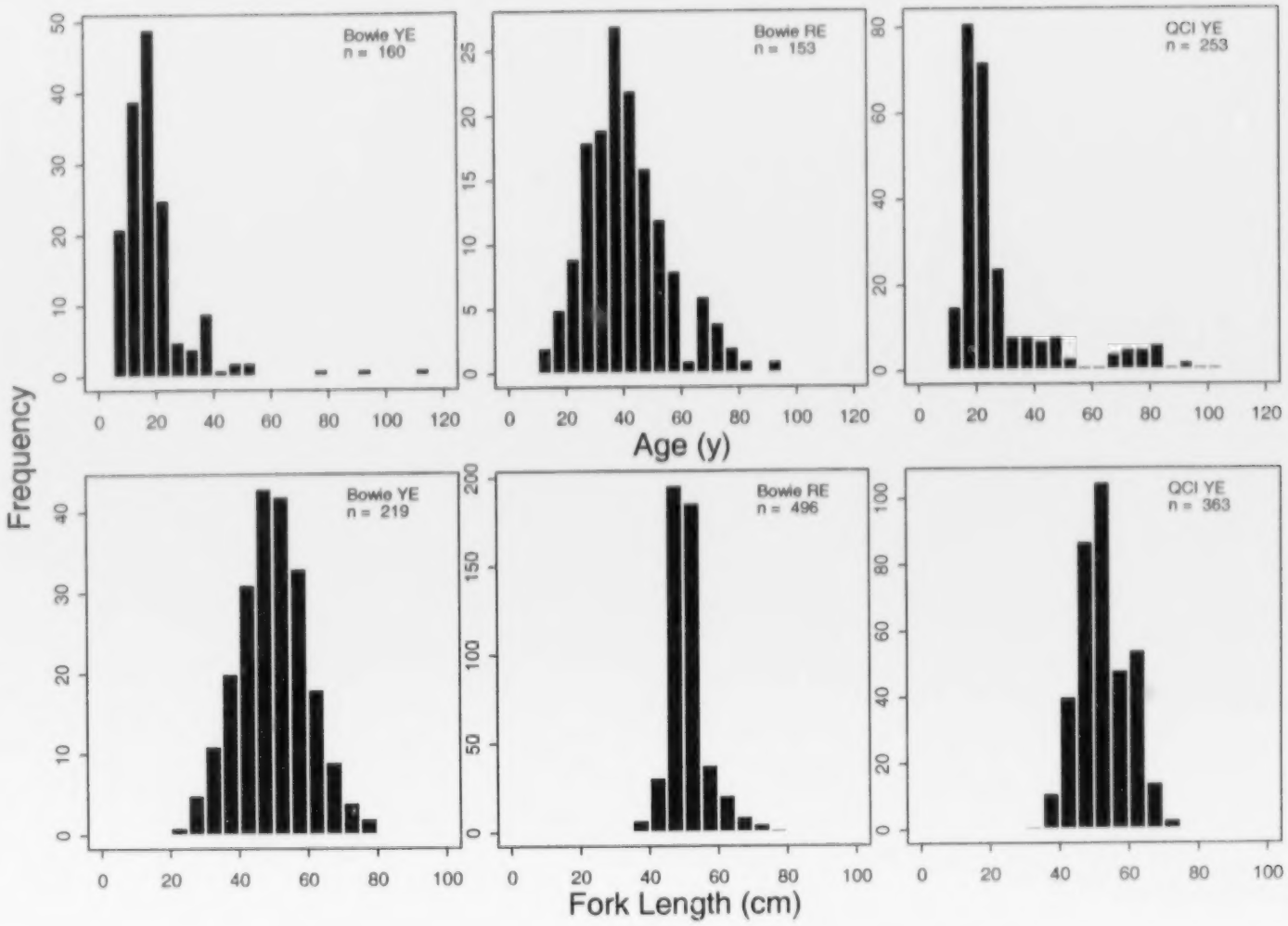

Figure 8. Age (top panels) and forklength (bottom panels) frequencies for yelloweye (YE) and rougheye (RE) rockfish at Bowie seamount and yelloweye rockfish in the Queen Charlotte Islands (QCI). n=sample size.

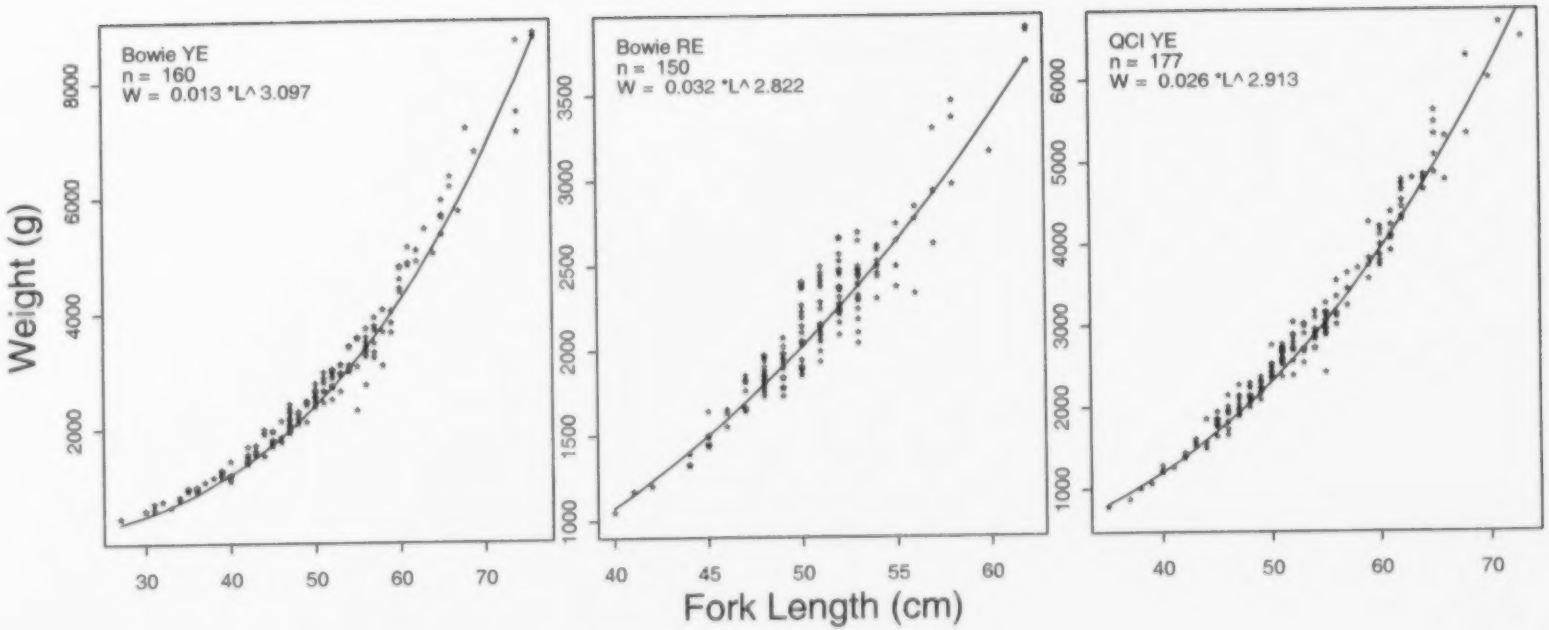

Figure 9. Length-weight relationship for yelloweye and rougheye rockfish caught by longline at Bowie seamount and yelloweye rockfish in the Queen Charlotte Islands (QCI). n=sample size.

Table 1. Summary of DELTA submersible dives with date and start time, type of dive, duration, pilot and observer names and general location.

Dive	Date	Dive Start	Dive Type	Duration (min)	Pilot	Observer	Location
5181	1/8/2000	17:07:00	Checkout	54	Chris Ijames	Lynne Yamanaka	Hunt Rock
5182	3/8/2000	13:26:00	Transect	103	Dave Slater	Lynne Yamanaka	Bowie Seamount
5183	5/8/2000	9:34:00	Transect	132	Chris Ijames	Rick Stanley	Bowie Seamount
5184	5/8/2000	12:23:00	Transect	101	Dave Slater	Lynne Yamanaka	Bowie Seamount
5185	5/8/2000	15:22:00	Transect	110	Chris Ijames	Rick Stanley	Bowie Seamount
5186	6/8/2000	8:37:00	Transect	102	Dave Slater	Lynne Yamanaka	Bowie Seamount
5187	6/8/2000	11:11:00	Transect	104	Chris Ijames	Rick Stanley	Bowie Seamount
5188	6/8/2000	14:17:00	Transect	86	Dave Slater	Lynne Yamanaka	Bowie Seamount
5189	7/8/2000	8:36:00	Transect	74	Chris Ijames	Rick Stanley	Bowie Seamount
5190	7/8/2000	10:21:00	Photography	74	Dave Slater	Linda Snook	Bowie Seamount
5191	7/8/2000	12:48:00	Transect	96	Chris Ijames	Lynne Yamanaka	Bowie Seamount
5192	7/8/2000	16:00:00	Transect	93	Dave Slater	Rick Stanley	Bowie Seamount
5193	8/8/2000	18:01:00	Transect	88	Chris Ijames	Lynne Yamanaka	Anthony Island
5194	8/9/2000	11:01:00	Aborted	65	Dave Slater	Rick Stanley	Lyman Point
5195	8/9/2000	12:43:00	Transect	83	Chris Ijames	Lynne Yamanaka	Lyman Point
5196	8/9/2000	15:44:00	Transect	50	Joe Lilly	Rick Stanley	Garcin Rock
5197	8/9/2000	16:58:00	Bounce	49	Joe Lilly	Tom Tomasic	Garcin Rock
5198	8/10/2000	8:33:00	Transect	80	Dave Slater	Lynne Yamanaka	Barber Point
5199	8/10/2000	10:40:00	Transect	75	Chris Ijames	Rick Stanley	Barber Point
5200	8/10/2000	12:45:00	Transect	80	Dave Slater	Lynne Yamanaka	Barber Point
5201	8/10/2000	15:25:00	Transect	87	Chris Ijames	Rick Stanley	Barber Point
5202	8/11/2000	9:05:00	Transect	62	Dave Slater	Lynne Yamanaka	Anthony Island
5203	8/11/2000	11:11:00	Transect	89	Chris Ijames	Rick Stanley	Cape Freeman
5204	8/11/2000	13:27:00	Photography	49	Dave Slater	Linda Snook	Nagas Point
5205	8/11/2000	14:48:00	Bounce	65	Chris Ijames	Gerry Dalum	Nagas Point
5206	8/11/2000	16:26:00	Transect	69	Dave Slater	Lynne Yamanaka	Nagas Point
5207	8/12/2000	7:56:00	Bounce	19	Joe Lilly	Paul Preston	Flatrock Island
5208	8/12/2000	8:39:00	Bounce	25	Joe Lilly	Steve Sviatko	Flatrock Island
5209	8/12/2000	9:22:00	Bounce	24	Joe Lilly	Sheila Dawe	Flatrock Island
5210	8/12/2000	10:05:00	Bounce	12	Joe Lilly	Rich Marriot	Flatrock Island
5211	8/12/2000	10:33:00	Bounce	8	Joe Lilly	Tawnya Petersib	Flatrock Island

Table 2. Summary of DELTA submersible dive number and transects conducted, depths, starting position and the total yelloweye and rougheye rockfish counted visually during the dive.

Dive	Transect	Depth (m)		Starting position		Total count	
		Min	Max	Latitude	Longitude	Yelloweye	Rougheye
	1	100	169	53.293	-135.6492		
5182	2	73	100	53.297	-135.6563	231	0
	1	247	306	53.273	-135.7126		
5183	2	224	243	53.272	-135.721	0	200
	1	157	233	53.279	-135.7283		
5184	2	146	157	53.284	-135.737	126	51
	1	250	300	53.296	-135.6352		
5185	2	195	254	53.294	-135.6443	0	661
	1	242	260	53.32	-135.6131		
5186	2	100	244	53.316	-135.6133	1	557
	1	203	290	53.324	-135.6097		
5187	2	105	195	53.318	-135.6167	3	241
	1	114	218	53.311	-135.6456		
5188	2	67	115	53.307	-135.6558	131	3
	1	100	183	53.298	-135.6991		
5189	2	76	99	53.301	-135.6915	186	9
	1	105	177	53.292	-135.715		
5191	2	72	100	53.293	-135.7097	410	15
	1	95	210	53.294	-135.6804		
5192	2	53	97	53.301	-135.6817	239	1
	1	169	200	52.056	-131.2627		
5193	2	133	160	52.06	-131.2523	9	0
	1	125	153	52.144	-130.941		
5195	2	78	117	52.141	-130.9442	4	0
5196	1	114	147	52.203	-130.9461	1	0
	1	127	158	51.983	-131.1462		
5198	2	95	115	51.983	-131.1359	30	0
	1	152	178	51.958	-131.1109		
5199	2	62	152	51.96	-131.0991	12	0
	1	0	196	51.931	-131.08		
5200	2	0	160	51.934	-131.0703	19	0
	1	180	220	51.99	-131.1668		
5201	2	120	185	51.989	-131.1562	13	0
	1	150	175	53.0851	-135.2895		
5202	2	147	153	53.0897	-135.2835	3	2
	1	202	231	52.107	-131.3506		
5203	2	0	191	52.108	-131.3426	13	0
	1	177	220	52.159	-131.3987		
5206	2	0	177	52.163	-131.3916	8	0

Table 3. List of rock samples collected with the *Delta* submersible showing dive number, location (degree minutes), depth, date and time of collection.

Rock Samples				
Dive	Latitude	Longitude	Trackpoint Depth(m)	Date/Time
5183	53.2793	-135.7235	-224	8/5/00 11:14 AM
5186	53.3173	-135.6242	-100	8/6/00 9:59 AM
5187	53.3178	-135.6247	-105	8/6/00 12:41 PM
5188	53.3067	-135.6553	-115	8/6/00 3:01 PM
5193	52.0594	-131.2535	-160	8/8/00 6:47 PM
5195	52.1414	-130.9440	-121	8/9/00 1:34 PM

Table 4. Common and scientific names, species codes and numbers of rougheye and yelloweye rockfish counted during Delta submersible dives at Bowie seamount. Other species observed during dives are listed.

Common Name	Scientific name	Species Code	Number	Min. Depth (m)	Max. Depth (m)	Mean Depth (m)
ROCKFISH						
Rougheye rockfish	*Sebastes aleutianus*	394	1738	103	301	249.5
Yelloweye rockfish	*Sebastes ruberimus*	442	1327	49	232	87.5
Pacific ocean perch	*Sebastes alutus*	396				
Redbanded rockfish	*Sebastes babcocki*	401				
Silvergray rockfish	*Sebastes brevispinus*	405				
Widow rockfish	*Sebastes entomelas*	417				
Rosethorn rockfish	*Sebastes helvomaculatus*	421				
Tiger rockfish	*Sebastes nigrocinctus*	433				
Sharpchin rockfish	*Sebates zacentrus*	450				
FLATFISH						
Pacific halibut	*Hippoglossus stenolepis*	614				
Flatfishes	Pleuronectiformes	597				
OTHER GROUNDFISH						
Eelpouts	Zoarcidae	231				
Ronquils	Bathymasteridae	317				
Pricklebacks	Stichaeidae	324				
Prowfish	*Zaprora silenus*	359				
Sablefish	*Anoplopoma fimbria*	455				
Poachers	Agonidae	546				
Sturgeon poacher	*Podathecus acipenserinus*	550				

Table 5. Common and scientific names, species codes and numbers of rougheye and yelloweye rockfish counted during Delta submersible dives in the Queen Charlotte Islands. Other species observed during dives are listed.

Common Name	Scientific name	Species Code	Number	Min. Depth (m)	Max. Depth (m)	Mean Depth (m)
ROCKFISH						
Rougheye rockfish	*Sebastes aleutianus*	394	2	220	220	220
Yelloweye rockfish	*Sebastes ruberimus*	442	112	59	220	139.5
Bocaccio	*Sebastes paucispinis*	435				
Canary rockfish	*Sebastes pinniger*	437				
Darkblotched rockfish	*Sebastes crameri*	410				
Greenstriped rockfish	*Sebastes elongatus*	414				
Harlequin rockfish	*Sebastes variegatus*	446				
Pygmy rockfish	*Sebastes wilsoni*	448				
Quillback rockfish	*Sebastes maliger*	424				
Redbanded rockfish	*Sebastes babcocki*	401				
Redstripe rockfish	*Sebastes proriger*	439				
Rosethorn rockfish	*Sebastes helvomaculatus*	421				
Sharpchin rockfish	*Sebastes zacentrus*	450				
Silvergray rockfish	*Sebastes brevispinis*	405				
Tiger rockfish	*Sebastes nigrocinctus*	433				
Yellowtail rockfish	*Sebastes flavidus*	418				
FLATFISH						
Dover sole	*Microstomus pacificus*	626				
Flatfishes	*Pleuronectiformes*	597				
Pacific halibut	*Hippoglossus stenolepis*	614				
Rex sole	*Errex zachirus*	610				
Slender sole	*Eopsetta exilis*	625				
OTHER GROUNDFISH						
Eelpouts	Zoarcidae	231				
Lingcod	*Ophiodon elongatus*	467				
Pacific cod	*Gadus macrocephalus*	222				
Pacific hake	*Merluccius productus*	225				
Pricklebacks	Stichaeidae	324				
Prowfishes	Zaproridae	358				
Ronquils	Bathymasteridae	317				
Sturgeon poacher	*Podathecus acipenserinus*	550				

Table 6. Summary of F/V Double Decker fishing locations by date, set number, hook count (14/0 hook size), start time, location (degree minutes) and depth (metres). Sets 1 to 9 were on Bowie Seamount and sets 10 to 17 were in the Queen Charlotte Islands.

				Latitude(deg min)		Longitude (deg min)		Depth (m)		
Date	Set	hook count	Start Time	Start	End	Start	End	Start	End	Modal
8/3/2000	1	260	4:13:00 AM	53° 17.7	53° 18	135° 39.3	135° 38.9	110	44	77
8/4/2000	2	246	11:00:00 AM	53° 16.2	53° 16.4	135° 41.7	135° 41	549	549	549
8/4/2000	3[1]	6 traps	8:00:00 PM	53° 17	53° 17.1	135° 44.3	135° 44	146	205	175.5
8/5/2000	4	490	6:00:00 PM	53° 17.8	53° 17.5	135° 38.2	135° 39.1	210	219	214.5
8/5/2000	5	430	6:43:00 PM	53° 16.3	53° 16.7	135° 42.8	135° 43.5	274	221	247.5
8/6/2000	6	522	10:55:00 AM	53° 18.9	53° 19.2	135° 36.6	135° 37.6	265	165	215
8/6/2000	7[2]	208	4:55:00 PM	53° 18	53° 17.8	135° 38.9	135° 39.3	73	77	75
8/6/2000	8	268	5:40:00 PM	53° 18.5	53° 18.5	135° 39.3	135° 40	115	77	96
8/7/2000	9	309	12:20:00 PM	53° 17.9	53° 18	135° 41.9	135° 41	183	99	141
8/8/2000	10	376	8:15:00 PM	52° 3.8	52° 3.4	131° 14.5	131° 15.7	128	113	120
8/9/2000	11	437	2:45:00 PM	52° 8.6	52° 8.4	130° 56.2	130° 57.1	137	62	99
8/10/2000	12	609	5:15:00 PM	51° 59	51° 59	131° 8.8	131° 7.5	157	93	125
8/10/2000	13	560	6:08:00 PM	51° 55.9	51° 56.1	131° 4.2	131° 3.5	183	121	152
8/10/2000	14	542	6:44:00 PM	51° 57.8	51° 57.5	131° 5.3	131° 6.4	55	168	111
8/11/2000	15	470	7:30:00 AM	51° 59.5	51° 59.4	131° 9.1	131° 10	225	146	185
8/11/2000	16	411	6:35:00 PM	52° 6.4	52° 6.4	131° 21.1	131° 20.1	236	183	209
8/11/2000	17	446	7:05:00 PM	52° 5.2	52° 5.5	131° 17.5	131° 16.6	–	–	–

[1]prawn traps used on this set
[2]smaller hooks (2/0) used on this set

Table 7. Summary of catch (numbers) by species and set number for all F/V Double Decker fishing sets at Bowie seamount.

Common Name	Scientific Name	code	1	2	3	4	5	6	7	8	9	Totals
Greenstriped rockfish	*Sebastes elongatus*	414				1						1
Harlequin rockfish	*Sebastes variegatus*	446					1					1
Pacific ocean perch	*Sebastes alutus*	396				1						1
Redbanded rockfish	*Sebastes babcocki*	401				2	2					4
Rosethorn rockfish	*Sebastes helvomaculatus*	421	27				4	11	34	59	94	229
Rougheye rockfish	*Sebastes aleutianus*	394		14		263	118	82			20	497
Shortraker rockfish	*Sebastes borealis*	403		6								6
Shortspine thornyhead	*Sebastolobus alascanus*	451		5								5
Silvergray rockfish	*Sebastes brevispinis*	405	1						1		1	3
Widow rockfish	*Sebastes entomelas*	417						1			2	3
Yelloweye rockfish	*Sebastes ruberrimus*	442	62					11	59	20	67	219
Pacific halibut	*Hippoglossus stenolepis*	614	5			1	1	2		13	5	27
Hairy triton	*Fusitriton oregonesis*	10A			4							4
Grenadiers	Macrouridae	249		1								1
Longnose skate	*Raja rhina*	059				2	14	8		2		26
Poachers	Agonidae	546							2			2
Red irish lord	*Hemilepidotus hemilepidotus*	502							1	1		2
Sablefish	*Anoplopoma fimbria*	455		6			5	2				13
Sculpins	Cottidae	472	1									1
Starfish	Asteriodea	4GA	2	7	3	7	9	30	1		1	60

Table 8. Summary of catch (numbers) by species and set number for all F/V Double Decker longline fishing sets in the Queen Charlotte Islands.

Common Name	Scientific Name	code	10	11	12	13	14	15	16	17	Totals
Bocaccio	*Sebastes paucispinis*	435			5	4					9
Canary rockfish	*Sebastes pinniger*	437	16	7	80	52	26		4	4	189
China rockfish	*Sebastes nebulosus*	431					1				1
Greenstriped rockfish	*Sebastes elongatus*	414	2						1		3
Quillback rockfish	*Sebastes maliger*	424		14			2				16
Redbanded rockfish	*Sebastes babcocki*	401	2	14	10	8	8	16	10	39	107
Rosethorn rockfish	*Sebastes helvomaculatus*	421	7	3	22	11		1	11	9	64
Rougheye rockfish	*Sebastes aleutianus*	394						1			1
Silvergray rockfish	*Sebastes brevispinis*	405	16	14	34	29	9	8	10	36	156
Yelloweye rockfish	*Sebastes ruberrimus*	442	37	17	82	86	25	29	25	64	365
Yellowmouth rockfish	*Sebastes reedi*	440						2			2
Yellowtail rockfish	*Sebastes flavidus*	418				1	1				2
Arrowtooth flounder	*Atheresthes stomias*	602		5			6			1	12
Pacific halibut	*Hippoglossus stenolepis*	614	1	10	15	4	90	2	10	4	136
Petrale sole	*Eopsetta jordani*	607					5				5
Big skate	*Raja binoculata*	056					4			5	9
Blue shark	*Prionace glauca*	041		1					1		2
Lingcod	*Ophiodon elongatus*	467		1	9	7	14	2		5	38
Longnose skate	*Raja rhina*	059		2	4		1	5	1		13
Pacific cod	*Gadus macrocephalus*	222	1				2				3
Sablefish	*Anoplopoma fimbria*	455		3				1			4
Sandpaper skate	*Bathyraja interrupta*	058							1		1
Spiny dogfish	*Squalus acanthias*	044	3	14	1	1	2	6	3	2	32
Spotted ratfish	*Hydrolagus colliei*	066	1	21	6		7			1	36
Starfish	Asteriodea	4GA		3	2		3			2	10

Table 9. Number of biological samples (N) collected by species. Sample types include length and sex (L/S), maturity and otoliths (M/O) for all longline fishing sets on the F/V Double Decker at Bowie Seamount…..

Common Name	Scientific name	L/S	M/O
Greenstriped rockfish	*Sebastes elongatus*	1	
Harlequin rockfish	*Sebastes variegatus*	1	
Longnose skate	*Raja rhina*	8	
Pacific ocean perch	*Sebastes alutus*	1	
Red irish lord	*Hemilepidotus hemilepidotus*	1	
Redbanded rockfish	*Sebastes babcocki*	2	
Redstripe rockfish	*Sebastes proriger*	2	
Rosethorn rockfish	*Sebastes helvomaculatus*	227	
Rougheye rockfish	*Sebastes aleutianus*	496	159
Sablefish	*Anoplopoma fimbria*	2	
Shortraker rockfish	*Sebastes borealis*	6	6
Shortspine thornyhead	*Sebastolobus alascanus*	5	
Silvergray rockfish	*Sebastes brevispinis*	2	
Widow rockfish	*Sebastes entomelas*	3	
Yelloweye rockfish	*Sebastes ruberrimus*	219	161

Table 10. Number of biological samples collected by species. Sample types include length (L), sex (S), maturity (M) and otoliths (O) for all longline fishing sets on the F/V Double Decker in the Queen Charlotte Islands.

Common Name	Scientific name	L/S	M	O
Arrowtooth flounder	*Atheresthes stomias*	11	1	
Big skate	*Raja binoculata*	6		
Blue shark	*Prionace glauca*	2		
Bocaccio	*Sebastes paucispinis*	9		
Canary rockfish	*Sebastes pinniger*	186	55	50
China rockfish	*Sebastes nebulosus*	1		
Greenstriped rockfish	*Sebastes elongatus*	2		
Lingcod	*Ophiodon elongatus*	35	5	
Longnose skate	*Raja rhina*	13		
Pacific cod	*Gadus macrocephalus*	3		
Petrale sole	*Eopsetta jordani*	5		
Quillback rockfish	*Sebastes maliger*	16		
Redbanded rockfish	*Sebastes babcocki*	104	57	57
Rosethorn rockfish	*Sebastes helvomaculatus*	63	11	
Rougheye rockfish	*Sebastes aleutianus*	1		
Sablefish	*Anoplopoma fimbria*	1		
Sandpaper skate	*Bathyraja interrupta*	1		
Silvergray rockfish	*Sebastes brevispinis*	156	54	
Skates	*Rajidae*	2		
Spiny dogfish	*Squalus acanthias*	14		
Spotted ratfish	*Hydrolagus colliei*	33		
Yelloweye rockfish	*Sebastes ruberrimus*	363	282	253
Yellowmouth rockfish	*Sebastes reedi*	2		
Yellowtail rockfish	*Sebastes flavidus*	2		

Table 11. Summary statistics for length, weight, and age for yelloweye and rougheye rockfish and length for rosethorn rockfish from F/V Double Decker longline fishing sets at Bowie seamount.

	yelloweye rockfish			rougheye rockfish			rosethorn
	Length (cm)	Weight (g)	Age (y)	Length (cm)	Weight (g)	Age (y)	Length (cm)
Count	219	160	160	496	150	153	227
Minimum	25	340	7	29	1010	13	24
Median	50	2410	18	51	2160	39	33
Maximum	76	8700	112	78	3850	93	38
Stdev	10.1	1695.1	13.6	5.7	478.4	14.6	2.6

Table 12. Summary statistics for length, weight and age for yelloweye rockfish and length for rosethorn, redbanded, silvergray and canary rockfishes, lingcod and ratfish from F/V Double Decker longline fishing sets in the Queen Charlotte Islands.

	yelloweye rockfish			rosethorn	redbanded	silvergray	canary	lingcod	ratfish
	Length (cm)	Weight (g)	Age (y)	Length (cm)	Length (cm)	Length (cm)	Length (cm)	Length (cm)	Length (cm)
Count	363	177	253	63	104	156	186	35	33
Minimum	35	700	13	24	32	40	39	66	45
Median	52	2610	22	29	45	51.5	53	87	50
Maximum	73	6600	101	43	57	66	64	111	62
Stdev	7.2	1167.2	19.1	2.7	4.2	4.6	4.2	12.4	5.5

LEFT BLANK ON PURPOSE

Appendix 1. PACIFIC REGION CCG VESSEL -POST CRUISE REPORT

NAME OF SHIP/PLATFORM: CCGS John P. TULLY

DATE:2000 FROM: 31 JulyTO: 14 August

SCIENCE CRUISE NUMBER: 2000-31 SHIP'S PATROL NUMBER:

CHIEF SCIENTIST[S]: Kae Lynne Yamanaka / Richard Stanley / John Dower

AREAS OF OPERATION: Bowie Seamount / Gwaii Haanas, Queen Charlotte Islands

INTRODUCTION/PROGRAM BACKGROUND:
This program was designed to develop new non-intrusive in-situ assessment methods for inshore rockfish using the DELTA submersible and to compare these methods with traditional fishery dependent indices.

CRUISE OBJECTIVE/OBJECTIVES:
Collect data to:
Develop a visual index of inshore rockfish abundance through submersible observations.
Describe inshore rockfish distribution, abundance, co-existing species associations and habitat.
Compare the visual index with a traditional fishing index.

DAYS ALLOCATED: 14 days DAYS OF OPERATION: 14 days
DAYS LOST DUE TO WEATHER: 1 entire dive day, 2 partial dive days

RESULTS:

Initial submersible / fishing impressions are:
Direct observations (videotape records) from the DELTA submersible are an excellent means of obtaining ecological data.
Visual indices can be developed using 25 minute visual counts along a line transect viewed from the starboard port and videotaped records from both a forward and a starboard video cameras.
Visual estimates of species composition matched those from longline fishing for fish species susceptible to hook and line gear.
Oceanography:
Haida eddy was situated over Bowie Seamount.
See sample summary attached

Radioisotope Use: Decommission lab and report use to IOS RSO (Radioisotope Use & Wipe test forms attached) Not applicable

PROBLEMS [SCIENTIFIC GEAR AND OPERATIONS]:
Minor problems with the DELTA submersible operations.

While launching the DELTA submersible on dive 5193 August 8 a rope used to secure the stern of the submersible was briefly caught in the submersible's propeller, bending a blade slightly. The submersible was retrieved and the blade hammered out. This caused an hour delay in operations.
DELTA submersible's navigational equipment (mounted on the charter vessel) failed to respond at the initiation of dive 5194 August 9. Voice communication was used to abort the dive according to safety protocol. Another track-point transducer was then mounted on the charter vessel to remedy the situation resulting in a 2-hour delay of operations.

Minor problems with the oceanographic operations.

A lanyard broke on one of the Go-Flo bottles on the CTD rosette. John Dower reported this to Tom Juhasz.
A rope on the electric tugger winch on the A-frame (raises and lowers the counter-weight below the CTD) broke during a deployment. John Dower reported this incident to both Frank Whitney and Tom Juhasz.

A nuisance.

The lack of detailed bathymetry for Bowie Seamount and nearshore areas on the West Side of the Queen Charlotte Islands made pre-planning of the exact dive positions difficult. Decisions on dive locations for the survey were contingent on the depth. Hence, each dive position could only be determined prior to each dive and required the constant attention of the Chief Scientist, Ship's commander and charter vessel.

SUCCESSES [SCIENTIFIC]:
DELTA submersible dives

Completed 1 dive at Hunt Rock near Port Hardy (under consideration for a marine protected area (MPA)), 11 dives at Bowie Seamount (pilot MPA) and 19 dives at Gwaii Haanas National Park Reserve, Queen Charlotte Islands. Dives were conducted to depths of 334 metres and for up to 1 hr and 12 minutes. Twenty submersible transects were conducted at both Bowie Seamount and Gwaii Haanas. Approximately 50 videotapes (Hi-8 and digital) were recorded, 200 - 35 mm exposures of habitat and 336 - 35 mm exposures of fish and invertebrates over the cruise.

Fishing experiments

Eight longline sets were completed at both Bowie Seamount and Gwaii Haanas. Bridge log data as well as catch by hook were recorded. From these sets 715 fish were biosampled for LWSMO and 605 fish for DNA, all other rockfish were sampled for L/S. In addition 141 fish were dissected and samples taken for pathology, virology and histology. Invertebrate samples were taken from sablefish and prawn trap gear as well as the hook and line gear.

Oceanography

CTD rosette casts and bongo tows were conducted at 33 stations both at Bowie Seamount and Gwaii Haanas. CTD data as well as water samples for the analysis of dissolved nutrients and size fractionated chloropyll were collected. Two vertical bongo net tows (0-50 m and 0-150 m) were conducted at each station. Neuston net tows were also conducted at the surface over Bowie Seamount.

Seabird and marine mammal observations

Seabird and marine mammal observations were conducted during the entire cruise. Notable observations were Peregrine Falcons, Right Whale dolphins and beaked whales.

PROBLEMS [SHIP'S EQUIPMENT/OPERATIONS/PLATFORM SUITABILITY]:
Prior to this cruise it was deemed necessary to carry out submersible communication/navigation from a separate vessel as the JPTULLY engine 'noise' interfered with transmissions. DELTA submersible operations in 1999, where tracking/communications were carried out onboard the JPTULLY, were not acceptable to the DELTA this year. It seemed, during the planning of the cruise, that the JPTULLY could not solely accommodate DELTA submersible operations.

During this cruise, coordinating the DELTA submersible operations between the JPTULLY and the chartered fishing vessel was awkward however safety was maintained through proper communication with the submersible.

Dive Operations

The dive day began with the launch of a small inflatable from the JPTULLY to transport the navigator to the chartered fishing vessel and then the lift of the DELTA submersible from its deck cradle to the tire mat at the side of the JPTULLY. At the end of the day the navigator would return to the JPTULLY and the DELTA submersible would be returned to the deck cradle.

DELTA launch procedure included:
a dive location was identified by location and depth;
this location was communicated to the chartered fishing vessel;
launch of small inflatable from the JPTULLY to 'stand-by' during submersible launch;
staffing of observer and pilot in submersible at the tire mat;
lift of submersible from the tire mat into the water;
release of submersible harness;
retrieve small inflatable.

Tracking and communication with the submersible was carried out onboard the chartered fishing vessel. JPTULLY would standby at a safe distance because they did not know the exact location of the submersible when underwater. After the submersible surfaced the JPTULLY would approach the DELTA for retrieval. This was often tedious for the DELTA as it is uncomfortable bobbing around on the surface waiting for the JPTULLY to approach (up to ½ hour).

Retrieval procedure included:
launch of small inflatable from the JPTULLY to 'stand-by' during submersible retrieval;
wait for the DELTA submersible to come alongside;
engagement of submersible harness;
lift of submersible to the tire mat;
retrieve small inflatable;
move to the next dive location.

Our most productive day was August 10 where four dives (5.5 hours) were conducted. This was a 0730 - 1800 hr day. Recommended improvements are suggested below.

SUCCESSES [SHIP]:
Despite the lack of bathymetry for the survey areas, the JPTULLY Bridge Officers were willing and able to accommodate our depth stratified sampling scheme by locating appropriate depths within the vicinity of the general lat/long coordinates given. The JPTULLY Deck Crew were required to transfer equipment and personnel to and from a chartered fishing vessel while at sea. These tasks were done with proficiency as were all other manoeuvres/exercises required for completion of the Science Program.

DELAYS [OTHER THAN WEATHER]:
Delayed at Seymour Narrows on the first day of the cruise.
Delays were experienced on the Port Hardy to Bowie Seamount leg (8 hours) and the Bowie Seamount to Gwaii Haanas leg (4 hours) due to the slower travelling speed of the chartered fishing vessel. DELTA dives could not be attempted until the chartered fishing vessel was alongside.

SAFETY CONCERNS:
The locker for the storage of flammables in the main laboratory is not well marked. I recommend that the locker be painted yellow and clearly marked with the appropriate symbols for flammables. This item was raised at a safety meeting onboard the vessel.

HAZARDOUS OCCURRENCES: None reported for Science operations.

EVENT LOG:

DATE	OPERATIONS
0830 - 31 Jul	mobilize DELTA submersible and crew, scientific staff and gear
1300	depart IOS for Port Hardy
1400 – 1 Aug	meet the Double Decker, transfer gear in Christie Pass
1700	DELTA dive 'check out' at Hunt Rock
1900	depart for Bowie Seamount
1600 – 2 Aug	CTD and bongo tow station
0530 – 3 Aug	arrive at Bowie Seamount start CTD and bongo tows
1300	DELTA dive, further diving stopped due to weather
0645 – 4 Aug	weather too severe for DELTA dives (25 kts, 2m swell)
0800 - 2000	CTD and bongo tows
5 – 7 Aug	DELTA dives, CTDs and bongo tows
1830 – 7 Aug	depart for Gwaii Haanas
1400 – 8 Aug	733 to Rose Harbour to pick up Tom Tomascik
1600	DELTA dive, further diving stopped due to weather
9 – 11 Aug	DELTA dives, CTDs and bongo tows
0730 - 12 Aug	DELTA dives
1045	demobilize the Double Decker
1130	depart for Esquimalt
0830 – 14 Aug	Esquimalt 'F' jetty, disembark Science personnel

SUMMARY/FINAL COMMENTS:

Recommendation for future work with the DELTA submersible on the JPTULLY.

The DELTA crew and Ship's crew discussed the possibility of improving the efficiency of operations by using a launch from the JPTULLY to conduct the communications/navigation for the DELTA submersible. They concluded that the Hydrographic launches are suitably powered and equipped to support a transducer pole as well as the communication/navigational equipment required to operate the DELTA. This would eliminate the need for a third party (chartered fishing vessel) and provide a more efficient and safe operation of the DELTA submersible. No travel time delays would be experienced and personnel transfers between vessels would not have to be carried out at sea.

We recommend that for future use of the DELTA submersible a Hydrographic launch be suitably equipped to accommodate DELTA's communication/navigation needs. This launch could be deployed from the starboard side, aft davit of the JPTULLY.

A direct link from the DELTA's navigation system (on the hydrographic launch) to the JPTULLY is required for the JPTULLY to identify the exact location of the DELTA submersible while it is underwater. This would increase efficiency during submersible retrieval and safety. A UHF transparent modem was required to accomplish this task however there were no units and no technical time available for this cruise.

It was a pleasure to work with Captain Frost, his officers and crew. Their congenial cooperation with the Science staff and program ensured a successful as well as enjoyable cruise. Thank-you all.

Appendix 2. Bowie Seamount 2000 Fish Health Survey Histological reference # H00-095

Fish were collected on Aug 3, 6, 7, 8, 9, 10 and 11th. Per each fish the following protocol was followed:

1. Note the otolith #, and fish species.
2. Blood collected and smear made to later check for the presence of EIBS (erythrocytic inclusion body syndrome) virus.
3. Kidney steriley collected and frozen for viral and bacteriological assays upon return to PBS.
4. On Aug. 10th and 11th, cultures of kidney was plated on 4 types of plates, TSA (Trypticase Soy Agar) which is a general medium, TCBS (Thiosulphate Citrate Bile Salt Sucrose Agar) specific for Vibrio spp., KDM-C (Kidney Disease Medium with Charcoal) which is specific for *Renibacterium salmoninarum*, the causative agent of BKD, and Connassie Blue which is specific for *Aeromonas* sp., or causative agent of Furunculosis.
5. For histology the following tissues were collected in Davidson's solution and will be processed and analyzed by Sheila Dawe. Collected were lower intestine, kidney, spleen, pyloric caecae, liver, heart, flesh, gills, and brain. Brain was only collected on the fish that had the otolith removed.

Date	Set #	Fish #	Ot. #	Species	Case #
03-Aug-0 1	(1)	1	1	Yelloweye dar	423
03-Aug-0 1	(1)	2	4	Yelloweye dar	423
03-Aug-0 1	(1)	3	6	Yelloweye dar	423
03-Aug-0 1	(1)	4	10	Yelloweye dar	423
03-Aug-0 1	(1)	5	12	Yelloweye dar	423
03-Aug-0 1	(1)	6	16	Yelloweye dar	423
03-Aug-0 1	(1)	7	20	Yelloweye dar	423
03-Aug-0 1	(1)	8	29	Yelloweye dar	423
03-Aug-0 1	(1)	9	36	Yelloweye dar	423
03-Aug-0 1	(1)	10	40	Yelloweye dar	423
06-Aug-0 1	(4)	11	1	Rougheye	424
06-Aug-0 1	(4)	12	5	Rougheye	424
06-Aug-0 1	(4)	13	11	Rougheye	424
06-Aug-0 1	(4)	14	16	Rougheye	424
06-Aug-0 1	(4)	15	21	Rougheye	424
06-Aug-0 1	(4)	16	26	Rougheye	424
06-Aug-0 1	(4)	17	31	Rougheye	424
06-Aug-0 1	(4)	18	39	Rougheye	424
06-Aug-0 1	(4)	19	44	Rougheye	424
06-Aug-0 1	(4)	20	50	Rougheye	424
06-Aug-0 1	(4)	21	1	Yelloweye bri	425
06-Aug-0 1	(4)	22	5	Yelloweye bri	425
06-Aug-0 1	(4)	23	7	Yelloweye bri	425
06-Aug-0 1	(4)	24	10	Yelloweye bri	425
06-Aug-0 1	(4)	25	N.A.	Blackcod	426
06-Aug-0 1	(4)	26	N.A.	Blackcod	426
06-Aug-0 1	(4)	27	N.A.	Widow	427

07-Aug-0 1 (7)	28	1	Yelloweye	428
07-Aug-0 1 (7)	29	5	Yelloweye	428
07-Aug-0 1 (7)	30	9	Yelloweye	428
07-Aug-0 1 (7)	31	13	Yelloweye	428
07-Aug-0 1 (7)	32	17	Yelloweye	428
07-Aug-0 1 (7)	33	22	Yelloweye	428
07-Aug-0 1 (7)	34	25	Yelloweye	428
07-Aug-0 1 (7)	35	30	Yelloweye	428
07-Aug-0 1 (7)	36	33	Yelloweye	428
07-Aug-0 1 (7)	37	37	Yelloweye	428
07-Aug-0 1 (7)	38	40	Yelloweye	428
07-Aug-0 1 (7)	39	43	Yelloweye	428
07-Aug-0 1 (7)	40	47	Yelloweye	428
07-Aug-0 1 (7)	41	50	Yelloweye	428
07-Aug-0 1 (7)	42	N.A.	Silvergrey	429
07-Aug-0 1 (7)	43	N.A.	Widow	430
07-Aug-0 1 (7)	44	N.A.	Widow	430
07-Aug-0 1 (7)	45	L68/S2	Rougheye	431
07-Aug-0 1 (7)	46	L67/S2	Rougheye	431
07-Aug-0 1 (7)	47	L66/S2	Rougheye	431
07-Aug-0 1 (7)	48	L68/S2	Rougheye	431
07-Aug-0 1 (7)	49	L70/S2	Rougheye	431
07-Aug-0 1 (7)	50	L65/S2	Rougheye	431
08-Aug-0 1 (8)	51	1	Yelloweye	432
08-Aug-0 1 (8)	52	4	Yelloweye	432
08-Aug-0 1 (8)	53	11	Yelloweye	432
08-Aug-0 1 (8)	54	16	Yelloweye	432
08-Aug-0 1 (8)	55	22	Yelloweye	432
08-Aug-0 1 (8)	56	26	Yelloweye	432
08-Aug-0 1 (8)	57	36	Yelloweye	432
08-Aug-0 1 (8)	58	L76/S1	Silvergrey	433
08-Aug-0 1 (8)	59	L50/S2	Silvergrey	433
08-Aug-0 1 (8)	60	L51/S1	Canary	434
08-Aug-0 1 (8)	61	L55/S1	Canary	434
08-Aug-0 1 (8)	62	L52/S1	Canary	434
08-Aug-0 1 (8)	63	L42/S1	Canary	434
08-Aug-0 1 (8)	64	L58/S2	Canary	434
08-Aug-0 1 (8)	65	L46/S1	Canary	434
08-Aug-0 1 (8)	66	L32/S1	Rosethorn	435
08-Aug-0 1 (8)	67	L30/S2	Rosethorn	435
08-Aug-0 1 (8)	68	L32/S2	Rosethorn	435
08-Aug-0 1 (8)	69	L40/S2	Redbanded	436
08-Aug-0 1 (8)	70	L42/S2	Redbanded	436
08-Aug-0 1 (8)	71	L27/S1	Greenstriped	437
08-Aug-0 1 (8)	72	L67/S2	Greycod	438
09-Aug-0 1 (9)	73	N.A.	Blackcod	439

09-Aug-0 1 (9)	74	N.A.	Blackcod	439
09-Aug-0 1 (9)	75	N.A.	Blackcod	439
09-Aug-0 1 (9)	76	N.A.	Lingcod	440
09-Aug-0 1 (9)	77	N.A.	Lingcod	440
09-Aug-0 1 (9)	78	1	Yelloweye	441
09-Aug-0 1 (9)	79	5	Yelloweye	441
09-Aug-0 1 (9)	80	9	Yelloweye	441
09-Aug-0 1 (9)	81	14	Yelloweye	441
09-Aug-0 1 (9)	82	17	Yelloweye	441
09-Aug-0 1 (9)	83	N.A.	Quillback	442
09-Aug-0 1 (9)	84	N.A.	Quillback	442
09-Aug-0 1 (9)	85	N.A.	Quillback	442
09-Aug-0 1 (9)	86	N.A.	Silvergrey	443
09-Aug-0 1 (9)	87	N.A.	Silvergrey	443
09-Aug-0 1 (9)	88	N.A.	Silvergrey	443
09-Aug-0 1 (9)	89	N.A.	Redbanded	444
09-Aug-0 1 (9)	90	N.A.	Redbanded	444
09-Aug-0 1 (9)	91	N.A.	Redbanded	444
09-Aug-0 1 (9)	92	N.A.	Canary	445
09-Aug-0 1 (9)	93	N.A.	Canary	445
09-Aug-0 1 (9)	94	N.A.	Canary	445
09-Aug-0 1 (9)	95	N.A.	Canary	445
	96	No sample collected		
09-Aug-0 1 (9)	97	N.A.	Canary	445
10-Aug-0 1 (10)	98	N.A.	Yellowtail	446
10-Aug-0 1 (10)	99	N.A.	Boccacio	447
10-Aug-0 1 (10)	100	N.A.	Boccacio	447
10-Aug-0 1 (10)	101	19	Yelloweye	448
10-Aug-0 1 (10)	102	29	Yelloweye	448
10-Aug-0 1 (10)	103	36	Yelloweye	448
10-Aug-0 1 (10)	104	42	Yelloweye	448
10-Aug-0 1 (10)	105	50	Yelloweye	448
10-Aug-0 2 (11)	106	1	Canary	449
10-Aug-0 2 (11)	107	7	Canary	449
10-Aug-0 2 (11)	108	19	Canary	449
10-Aug-0 2 (11)	109	26	Canary	449
10-Aug-0 2 (11)	110	34	Canary	449
10-Aug-0 2 (11)	111	43	Canary	449
10-Aug-0 2 (11)	112	50	Canary	449
10-Aug-0 2 (11)	113	1	Yelloweye	450
10-Aug-0 2 (11)	114	S2	Lingcod	451
10-Aug-0 2 (11)	115	S2	Lingcod	451
10-Aug-0 2 (11)	116	S2	Lingcod	451
10-Aug-0 2 (11)	117	N.A.	Greycod	452
10-Aug-0 2 (11)	118	N.A.	Greycod	452
10-Aug-0 3 (12)	119	1	Yelloweye	453

10-Aug-0 3 (12)	120	7	Yelloweye	453
10-Aug-0 3 (12)	121	14	Yelloweye	453
11-Aug-0 3 (15)	122	N.A.	Blackcod	454
11-Aug-0 3 (15)	123	N.A.	Rougheye	455
11-Aug-0 3 (15)	124	N.A.	Yellowmouth	456
11-Aug-0 3 (15)	125	N.A.	Yellowmouth	456
11-Aug-0 3 (15)	126	10	Yelloweye	457
11-Aug-0 3 (15)	127	17	Yelloweye	457
11-Aug-0 3 (15)	128	24	Yelloweye	457
11-Aug-0 3 (15)	129	34	Yelloweye	457
11-Aug-0 3 (15)	130	50	Yelloweye	457
11-Aug-0 3 (15)	131	1	Redbanded	458
11-Aug-0 3 (15)	132	8	Redbanded	458
11-Aug-0 3 (15)	133	N.A.	Canary	459
11-Aug-0 1 (13)	134	N.A.	Canary	459
11-Aug-0 1 (13)	135	N.A.	Canary	459
11-Aug-0 1 (13)	136	N.A.	Canary	459
11-Aug-0 1 (13)	137	N.A.	Canary	459
11-Aug-0 1 (13)	138	N.A.	Canary	459
11-Aug-0 1 (13)	139	N.A.	Lingcod	460
11-Aug-0 1 (13)	140	N.A.	Lingcod	460
11-Aug-0 1 (13)	141	N.A.	Lingcod	460
11-Aug-0 1 (13)	142	N.A.	Lingcod	460

Note L#/S# is length and sex frequency data. Set # information is # (#), first # is the number of the set of the day, the number in brackets is the set # for the trip. I am not sure if I am correct past Set #8, as I sort of lost track, but if I looked at the raw catch data I could figure it out.

Sheila Dawe
Fish Health
Aquaculture Section
Fisheries and Oceans Canada
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, B.C. V9T 6N7

Appendix 3. Summary of Oceanographic Data Collected on John P. Tully Cruise July 31 - August 14, 2000. Note: All data held at UBC. Contact Dr. John Dower

CTD Data: A total of 33 CTD/Rosette casts were completed during the trip. Most of these were part of a 20 station grid centred on Bowie Seamount (53E 17.994'N, 135E 39.092'W). An additional 3 stations were collected approximately 50nm east of Bowie and served as to characterize "background conditions". Casts were generally to 400m, or to within 10m of the bottom over the seamount summit. The remaining 10 casts were located near the southern tip of the Queen Charlotte Islands. In addition to CTD data, water samples were collected at each station for the analysis of dissolved nutrients and size-fractionated chlorophyll. Locations of individual casts listed below.

Zooplankton Data: At each CTD station, two vertical tows (0-50m and 0-150m) were completed using 80cm bongo-nets fitted with 236 Φm mesh. Samples were visually inspected for the presence of larval fish. If larval fish were present, one cup was preserved in 95% ethanol and the second cup preserved in 5% buffered-seawater formalin. If no larval fish were present, both cups were preserved in formalin.

Station locations:

Cast #	Date	Time (PDT)	Latitude	Longitude	Depth (m)
001	08/02/00	1552	52E 18.93'N	132E 47.57'W	400
002	08/03/00	0814	53E 18.23'N	135E 56.91'W	400
003	08/03/00	1010	53E 18.39'N	135E 48.39'W	400
004	08/03/00	1826	53E 18.20'N	135E 39.84'W	80
005	08/03/00	2105	53E 18.17'N	135E 31.92W	400
006	08/03/00	2302	53E 21.15'N	135E 23.67'W	400
007	08/04/00	0754	53E 21.22'N	135E 48.56'W	400
008	08/04/00	0941	53E 21.17'N	135E 40.47'W	400
009	08/04/00	1208	53E 21.22'N	135E 31.97'W	400
010	08/04/00	1433	53E 15.36'N	135E 48.44'W	400
011	08/04/00	1616	53E 15.21'N	135E 56.90'W	400
012	08/04/00	1834	53E 15.14'N	135E 40.80'W	400
013	08/04/00	1904	53E 18.00N	135E 39.31W	35
014	08/04/00	2031	53E 24.20'N	135E 40.30'W	400
015	08/04/00	2201	53E 24.11'N	135E 31.68'W	400
016	08/04/00	2331	53E 24.08'N	135E 23.67'W	400
017	08/05/00	0118	53E 24.16'N	135E 15.40'W	400
018	08/05/00	1745	53E 15.22'N	135E 32.09'W	400
019	08/05/00	1958	53E 12.22'N	135E 40.35'W	400
020	08/05/00	2128	53E 12.20'N	135E 48.50'W	400
021	08/05/00	2302	53E 12.20'N	135E 56.85'W	400
022	08/07/00	0034	53E 12.20'N	136E 05.34'W	400

023	08/07/00	2221	53E 01.96'N	134E 42.30'W	400
024	08/09/00	2011	52E 00.07'N	130E 43.98'W	250
025	08/09/00	2134	52E 00.00'N	130E 51.00'W	190
026	08/09/00	2302	52E 00.03'N	130E 56.97'W	75
027	08/10/00	1803	52E 00.21'N	131E 09.28'W	50
028	08/10/00	1904	52E 00.12'N	131E 14.09'W	400
029	08/10/00	2030	52E 00.03'N	131E 20.01'W	400
030	08/10/00	2219	51E 59.98'N	131E 29.84'W	400
031	08/11/00	0000	52E 05.20'N	131E 23.28'W	400
032	08/11/00	0133	52E 07.37'N	131E 21.50'W	175
033	08/11/0	0237	52E 08.28'N	131E 19.40'W	75

Dr. John Dower
University of Victoria
Earth and Ocean Sciences
PO Box 3055 STN CSC
Victoria BC V8W 3P6

Canada

Appendix 4. CTD PROCESSING NOTES

Cruise: 2000-31
Agency: UBC
Location: Bowie Seamount/Queen Charlottes
Project: Bowie Seamount
Party Chief: John Dower
Platform: CCGS John P. Tully
Date: 31 July 2000 – 14 August 2000

Processed by: Germaine Gatien
Date of Processing: 31 May 2001 – 4 June 2001
Number of original CTD casts: 33
Number of casts processed: 33

INSTRUMENT SUMMARY

A SeaBird Model SBE 911+ CTD (#0550) was used. There was a fluorometer and a transmissometer mounted on the CTD. There are 2 userpoly channels in the con file suggesting that a second fluorometer and a PAR sensor may have been mounted on the CTD, but no data has been recorded in either channel.

SUMMARY OF QUALITY AND CONCERNS

The salinity is unusually spiky in areas of high temperature gradient.

PROCESSING SUMMARY

1. Seasave - This step was completed at sea; the raw data files have extension DAT.

2. Preliminary Steps

No Log Book was available, but a cruise report with positions and times was obtained.
No salinity calibration data was available.
The cruise summary sheet was completed.
The configuration file was obtained and the calibration constants were checked.
The sensor history was found.

3. Conversion of Raw Data

The data was converted using file 20310001.con. Two USERPOLY channels contained no data in three test casts, so were not converted. Rosette files were also created.
An initial examination of the data suggests that the sensors tracked each other reasonably well at depth, but near the surface the secondary temperature and salinity look extremely noisy. Similar problems were noted during 2000-24 in July 2000 using the same equipment.

The salinity channels were then stripped from the CNV files.

4. ALIGNCTD

It is not clear whether the secondary conductivity sensor has been aligned by the deck unit.
Information is available from 6 cruises using this equipment since the last calibration. In each case the primary sensors were chosen for archiving. Given that there are no bottle comparisons available for this cruise and that the secondary sensors are very noisy, the same choice will be made. For 2000-26 the deck alignment was found to be best for the primary channel. It was thus decided to skip the alignment step for this data set.

5. WILDEDIT
Program WILDEDIT was used to remove spikes in all channels except Scan_Number.
Parameters used were: Pass 1 Std Dev = 2 Pass 2 Std Dev = 5 Points per block = 50

6. CELLTM
The conductivity cell thermal mass correction was done for both channels (alpha = 0.03; 1/beta = 9.0.)

7. DERIVE
Program DERIVE was run twice:

1. on all casts to calculate primary and secondary salinity.
2. on all casts to calculate the differences between primary and secondary channels for temperature, conductivity and salinity. These were placed in a test directory and will not be archived.

8. Test Plots and Channel Check
A sample of casts (#1,14,16,31) was plotted to check for differences between the pairs of T and C sensors. The descent rate was quite good at #1, 16 and 31 but noisy and fairly low at #14. The differences in T, S and C at 400db are on the order of –0.0015 to –0.0025C°, -0.01units and –0.001units, respectively. The temperature differences were extremely noisy so this is a rough estimate. The conductivity and salinity differences are very similar to those observed during 2000-26.

The fluorometry channel and the transmissivity data look reasonable. Comparing the descent rate with the fluorometry trace suggests that the fluorometer was pumped.

9. Conversion to IOS Headers
The IOSSHELL routine was used to convert SEA-Bird 911+ data to IOS Headers. The ROS files were converted to IOS files, and the extensions were changed to BOT.

10. Checking Headers
A header summary was produced. For casts #13 through #21 the date in the cruise report does not agree with the NMEA date in the headers after adjusting for time zone. The speed check does not help resolve the discrepancy since the casts are close to one another. In the absence of a log it is assumed that the headers are correct since the times and positions do correspond to those in the report suggesting that the NMEA system was functioning properly.
The header check was produced and no errors were found.
The cruise track was plotted and looks reasonable.
CLEAN was run to replace pad values in Pressure with interpolated values.
The surface check was run. The average surface pressure is 0.02db which is low since logging is not usually started until the equipment is 1 or 2m below the surface. Examining a few casts suggests that the CTD was very close to the surface during the soak period. The sensor pairs are consistently in good agreement below about +0.4db. Above that, one or more sensors appear to occasionally leave the water.

11. Test Plots
Profiles of all casts were examined for any evidence of problems with the processing. As noted earlier the secondary temperature and salinity look very noisy. The primary salinity is also noisy in high-gradient areas, but is much better than the secondary. This spikiness has been noted in other cruises using this equipment. The salinity spikes tend to be bi-polar suggesting a problem with flow rate. This could be due to pump problems or the way the CTD was mounted. The descent rate, while fairly noisy, is no worse than for many other cruises when this problem was not noted. Away from large temperature gradients the up and down-casts are similar as are the two pairs of sensors.

12. DELETE

The following DELETE parameters were used:
Surface Record Removal: Last Press Min
Maximum Surface Pressure (relative): 10.00
Surface Swell Pressure Tolerance: 1.0
Pressure was filtered over width: 15
Swells deleted. Warning message if pressure difference of 2.00
Drop rates < 0.3m/s (calculated over 15 points) was deleted.
Sample interval = .04 seconds.

All DEL files were copied to EDT files.

13. DETAILED EDITING

Page plots were produced using T0,S0 for all casts. These plots were examined for spikes and instabilities and used to guide the use of CTDEDIT. There was a lot of noise in the salinity in the thermocline. As noted earlier the noise is bi-polar and will to some extent disappear with bin-averaging. However, an effort was made to remove outliers especially in sections where the variations were very large. Records were removed where shed wakes had clearly corrupted the data; this is usually only obvious away from the thermocline. Records were also removed for some casts at the surface. All casts were edited except for cast #33.

Note was made of the editing details in the relevant files. The edited files were copied to EDT files so that a complete set of files exists with either edited data or data that does not require editing.

Plots of temperature and salinity vs depth for the BOT files were examined to check for any bad values in these files. No obvious bad points were found.

14. BIN AVERAGE

The following Bin Average values were used for EDT files:
Bin channel = pressure
Averaging interval = 1.000
Minimum bin value = .000
Average value will be used
Interpolated values are NOT used for empty bins
The same values were used for the BOT files except that the Bin Channel = Bottle Number.

15. Intercomparisons

Previous experience with these sensors – These sensors have been used extensively since the last calibration and the comparison with bottles is as follows:

Mission	Start Date	Sensors 2173/2023	Sensors 1766/2371
2000-10	30/5/2000	High by 0.0058 (used for part of cruise)	Low by 0.0035
2000-17	17/07/2000	Very noisy	Very noisy
2000-24	24/7/2000	High by 0.003 (few bottles – deeper 2 give 0.006)	Low by 0.006 (few bottles deeper 2 give 0.007)
2000-26	21/8/2000	High by 0.005	Low by 0.005
2000-27	28/08/2000	High by 0.0042	Low by 0.005
2000-25	4/9/2000	High by 0.004 (varied during cruise)	Low by 0.007 (varied during cruise)

COMPARE – There was no bottle salinity data available.

Historic ranges – Historic data was available for most casts. All data fell within the ranges except for temperatures between 200 and 400m for casts #3, 10-13 and 18-21 which were often above the maximum by up to 0.1C°. Those casts were all in the south and west parts of the Bowie Seamount survey. Casts in the north and east of the Bowie Seamount area and the casts near the Queen Charlottes all fell within the ranges. So this probably reflects a real feature and not a problem with the processing.

16. Recalibration

Since no bottle comparison was possible recalibration was based on the results of cruise 2000-26 which followed 2000-31 and used the same equipment. File 2031rcal.ccf was used to lower the primary salinity by 0.005units and to raise the secondary salinity by 0.005units. The recalibration was applied to the cast files and rosette files.

17. REORDER

The following channels were removed from all CTD cast files: Scan_Number, Secondary Temperature, Secondary Salinity, Conductivity:Primary, Conductivity:Secondary and Flag.
The data format was corrected as needed. The output files had extensions CTD.
The following channels were removed from all rosette files: Scan_Number, Conductivity:Primary, Conductivity:Secondary and Flag. The output files had extensons RAC.

18. Final Plots and Cross-Reference Listing

THIN and DERIVE were run to obtain values for tables and page plots were prepared using the files with extensions CTD.
A cross-reference listing was produced.
As a final quality check casts from three lines were plotted on T-S surfaces: #6-9, 19-22 and 24-30. The agreement is excellent for 19-22 and reasonably close for the other two lines.

Particulars

20310013 – 20310021 – The dates in the report are one day earlier than the dates in the headers.

Institute of Ocean Sciences: CRUISE SUMMARY

Cruise ID#: 2000-31
Dates: Start: 31 July 2000 End: 14 August 2000
Location: Bowie Seamount / Queen Charlotte Islands
Vessel: CCGS John P. Tully
Chief Scientist: John Dower

CTD#	Make	Model	Serial#	Used with Rosette?	CTD Calibration Sheet Competed?
1	SEABIRD	911+	0550	Yes	yes

Institute of Ocean Sciences: CTD Calibration Information

Make/Model/Serial#: SEABIRD/911+/ 0550
Cruise ID#: 2000-31

Calibration Information

Sensor Name	S/N	Pre-Cruise Date	Location	Post Cruise Date	Location
Temperature	2023	07Dec1999	Factory		
Conductivity	2173	05May2000	"		
Secondary Temp.	2371	16June1999	"		
Secondary Cond.	1766	28Dec2000	"		
Transmissometer	CST333DR		IOS		
Fluorometer:pumped	2228	14 July 2000			
Fluorometer:unpump	2229		?		
Pressure Sensor	75636	4June1999	Factory		

Sensor Calibration Notes:
The configuration file used is attached; this includes the sensor calibrations.

Appendix 5. Trip Summary, Seabirds and Marine Mammals, Bowie Seamount, August 2 - 13 2000.

Between August 2nd and 13th 2000, Mike Bentley (on contract to the Canadian Wildlife Service) conducted 551 seabird survey transects aboard the John P. Tully. Each transect lasted 5 minutes long, with all birds encountered within 250 m of either side of the vessel recorded. All marine mammal observed (that could be identified), regardless of distance from the vessel, were also noted. Including observations made while not conducting surveys, a total of 24 species of seabirds and 6 species of marine mammals were observed.

This brief report summarises only what was noted while Bentley was conducting surveys. To quickly examine these data I arbitrarily elected to divide the transects into those that occurred within one radius of the pinnacle of Bowie Seamount (average radius estimated to be approximately 38 km) and those that were more than 38 km from the pinnacle. At this time, I have not calculated the length of each transect - consequently, I cannot compare densities per unit area surveyed. However, for comparison sake, I have calculated for each species of bird and mammal the average number seen per minute of observation within one radius of Bowie (= Bowie Area) and for those transects outside the Bowie area (= Non-Bowie Area).

A total of 21 bird species and 5 mammal species were observed during the surveys. Fifteen species were found only in Non-Bowie Areas (Table 1). Of the 6 remaining species that were seen in both areas, 4 species (Black-footed Albatross, Northern Fulmar, Fork-tailed Storm-Petrel and Leach's Storm-Petrel) were more numerous (per unit of time) in the Bowie Area. Of the 15 species of birds not encountered near Bowie, 9 were species that are generally found in coastal areas out to the edge of the continental shelf.

The 4 species of birds that were more numerous over the seamount belong to the Procellariiformes (or Tube-nose) family. Unlike most birds, Procellariids have highly developed olfactory organs and utilise scent to locate concentrations of prey. It was noted that there was a noticeable surface slick of oil in association with the seamount pinnacle. Although this cannot be verified, Bentley and others felt that this was a natural slick (perhaps from near-surface euphausiid concentrations?) rather than being of anthropogenic origin. Regardless of the source, it is suggested that the high concentrations of these 4 species over Bowie Seamount may have been related to the odour given off by the slick. Because Black-footed Albatrosses and Northern Fulmars are notoriously attracted to ships, their increased abundance over Bowie Seamount could have been due to the 'continuous' presence of one or more vessels in the pinnacle area. However, it is unlikely that the heightened number of Storm-Petrels was similarly caused by the presence of the boats.

Ken Morgan, Canadian Wildlife Service
c/o Institute of Ocean Sciences
Sidney, BC
6 September 2000

Appendix Table 1. Observed numbers and densities (number/minute of observation) of seabirds and marine mammals observed over Bowie Seamount (Bowie Area = within 38 km of the pinnacle) and off the Seamount (Non-Bowie Area = > 38 km from the pinnacle).

	Bowie Area		Non-Bowie Area	
Total Survey Time (minutes)	370		2375	
Birds	**Number**	**Density (no/min)**	**Number**	**Density (no/min)**
Black-footed Albatross	4	0.011	23	0.009
Northern Fulmar	38	0.103	142	0.059
Sooty Shearwater	2	0.005	213	0.089
Pink-footed Shearwater	0	0.000	132	0.056
Fork-tailed Storm-Petrel	932	2.519	19	0.008
Leach's Storm-Petrel	775	2.095	133	0.056
Red-necked Phalarope	0	0.000	158	0.066
Red Phalarope	0	0.000	11	0.005
Pelagic Cormorant	0	0.000	2	0.001
Pomarine Jaeger	0	0.000	7	0.003
Herring Gull	0	0.000	8	0.003
California Gull	0	0.000	228	0.096
Glaucous-winged Gull	0	0.000	115	0.048
Sabine's Gull	0	0.000	1	0.001
Arctic Tern	0	0.000	2	0.001
Pigeon Guillemot	0	0.000	5	0.002
Cassin's Auklet	4	0.011	708	0.298
Rhinoceros Auklet	0	0.000	590	0.248
Tufted Puffin	0	0.000	39	0.016
Common Murre	0	0.000	85	0.036
Xantus' Murrelet	0	0.000	2	0.001
Marine Mammals				
Dall's Porpoise	9	0.024	46	0.019
Pacific White-sided Dolphin	0	0.000	15	0.006
Northern Right-whale Dolphin	0	0.000	6	0.003
Baird's Beaked Whale	0	0.000	6	0.003
Humpback Whale	0	0.000	14	0.006

Appendix 6. Codes and descriptions for habitat classifications.

Codes and descriptions for habitat substrate classifications	
1	Artificial (pilings, tires, ships, etc)
2	Hardpan (e.g. sandstone)
3	Bedrock
4	Boulder (rocks > 25cm)
5	Cobble (6 - 25cm)
6	Mixed Coarse (cobble/gravel/shell)
7	Gravel (small rocks and pebbles 1 - 6cm)
8	Sand (or sand/shell)
9	Mud (or mud/shell)
Codes and descriptions for habitat relief	
1	None (flat or rolling)
2	Low (vertical relief 0.5 - 2m)
3	High (vertical relief > 2m)
4	Steep slope or wall
Codes and descriptions for habitat complexity classifications	
1	Simple (flat/rolling with no crevices)
2	Low (very few crevices)
3	Medium (more than a few but not lots of crevices)
4	High (lots of crevices)
Codes and descriptions for habitat biocover classifications	
1	Bare (<10% cover)
2	Kelp
3	*Ulva spp.*
4	Other algae
5	Algal mat
6	Scallops
7	Barnacles
8	Anemones (mainly *Metridium spp.)*
9	Encrusting organism complex (Psolus spp., barnacles, hydroids, bryozoans, anemones)
10	Eelgrass
11	Opiuroids
12	Tube worms/empty tubes
13	Debris/detritus
14	Sea pens/whips
15	Sponges
99	Unidentified
Codes and descriptions for habitat biocover thickness classifications	
1	0-25% cover
2	26-50% cover
3	51-75% cover
4	76-100% cover